faster than near the bottom, where the slope is less and there is the resistance of the *débris* lying on the level to be overcome, which can only be done by a *vis a tergo*, an impulse from behind. The *débris* coming slowly down from above and meeting with this obstacle gradually accumulates till it causes a bulging of the slope towards its base, which goes on increasing till the lower part of the hill is so steep that, to use a colloquial phrase, "it is touch and go" whether the hill can stand or not; then a burst of rain heavier than usual comes, the head of water is increased, the force of the water flowing out near the bottom is increased, it begins to wash away the *débris* near the bottom till the support, being removed from below small slips begin to fall; then a few larger, and finally comes the great slip which brings down the outer crust of half the hillside, leaving a precipitous border round that part from which it has come; finally, the great slip is followed by smaller ones, which leave the hill with a pretty uniform slope from top to bottom for the whole process to begin again. Such I believe to be the history of one of these landslips where there is no stream cutting at the base of the hill; where that is the case, slips may be formed at any time by the cutting away of the foot of the slope.

Although it may be possible to extend in detail the causes contributing to this gradual creep, it may as well be stated at once that I entirely agree with Mr. Oldham as to the existence of this creep, and would follow him further in considering, as he has done in subsequent years, this action to be more deep-seated than that indicated in the paper just quoted. To whatever depth this gradual lakeward movement may extend in the slates of Sher-ka-danda (and this depth will vary for reasons explained below), there is no doubt that subaërial water is the prime agent in the mischief, and its removal must be the leading, almost the only, consideration in framing remedial measures.

Ramsay Committee, 1880.

9. By a Resolution of the Government of the North-West Provinces and Oudh, dated 22nd September 1880, a Committee, under the presidency of Lieutenant-General Sir H. Ramsay, was appointed to ascertain, after the landslip of the 18th September, the real condition of the hill, and to frame protective measures for future safety.

10. The Ramsay Committee concluded that at that time no danger of further settlement existed west of Cheena Lodge, or east of Melville Hall; but that within these limits the hill-side was liable to slip where the slope was greater than 35°. These limits include

PROCEEDINGS OF THE THIRTY-SEVENTH INDIAN SCIENCE CONGRESS

PART III—ABSTRACTS

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37th INDIAN SCIENCE CONGRESS, POONA, 1950

SECTION OF MATHEMATICS

PRESIDENT: PROFESSOR N. M. BASU, D.Sc.

Abstracts

1. Analogues of some μ (n)-Theorems

HANSRAJ GUPTA, Hoshiarpur.

In this paper, the author proves analogues of some theorems involving the Mobius unction $\mu(n)$ when it is replaced by Liouville's function $\lambda(n)$. Thus it is shown that

$$g_h\,(n) = \sum_{d/n} \lambda\,(d) \log^h d$$

vanishes when the least number m which makes nm a perfect square has at least $(h+1)$ different prime divisors. In particular, $g_0(n)$ is equal to one or zero according as n is or is not a square. Some other striking results are :

$$\sum_{j=1}^{n} [n/j]\,\lambda\,(j) = [\sqrt{n}]\,;$$

$$\sum_{d_1 d_2 = n} d_1\,\lambda\,(d_2) = \sum_{d^2/n} \phi(n/d^2)$$

where ϕ is Euler's totient function.

2. Properties of a Ramanujan Function

OMAR ALI SIDDIQI, Aligarh.

Consider the Ramanujan Function $\phi(t) = \sum\limits_{n=1}^{\infty} \dfrac{n^{n-2}}{\lfloor n-1} t^{n-1} e^{-nt}$ for $t > 1$.

Auluck and Chowla [F. C. Auluck, Proc. Ind. Acad. Sc., 11 (1940), 376-8 ; S. C. Chowla and F. C. Auluck. Ind. Math. Soc. J. 4(1940), 169-173] proved the conjecture $(-1)^n \dfrac{d^n\phi}{dt^n} > 0$ for $n=1,\ 2,\ 3$ and also determined the numerical values of $\phi_1(1+0)$, $\phi_2\,(1+0)$, $\phi_3\,(1+0)$ {suffixes denoting differentiations}. The transformation $te^{-t} = \omega e^{-\omega}$ where $0 \leqslant \omega \leqslant 1$ and $t \geqslant 1$ was used. Shah (Bombay University Journal, Nov. 1948) and Sharma proved the conjucture for $n=4$ and determined $\phi_4(1+0)$. The author had (Proc. Ind. Sc. Congress, 1949) earlier developed a general method for determining any member of the sequence $\phi_1\,(1+0)$, $\phi_2\,(1+0)$, $\phi_3\,(1+0)$ etc. and proved the conjecture for $t=1+0$. The object of this paper is :—

(1) To establish the lemma

$$\phi_{n+1} = {}^nC_0\phi\omega_{n+1} + {}^nC_1\phi_1\omega_n + {}^nC_2\phi_2\omega_{n-1} + \ldots\ldots + {}^nC_n\phi_n\omega_1 - \phi_n.$$

(2). To give two different proofs for the conjecture when $t \geqslant n$.

(3) To develop a procedure for discussing the case $t \leqslant n$.

3. A Theorem on Partitions

N. M. Basu, Aligarh.

It is known (G. H. Hardy, *Some famous Problems of the Theory of Numbers and in particular Waring'sProblem*, 1920, p. 10) that the number of partitions of the positive integer n into parts not exceeding 3 is equal to the integer nearest to $(n+3)^2/12$, when the order of the parts is disregarded. It is natural to enquire whether a similar result is true when the order is taken into account.

Let B_n denote the number of partitions of n and $B_n^{(s)}$ denote the number of partitions of n into parts not exceeding S, the order of the parts being taken into account in both the cases. Thus, since

$$4=1+3=3+1=2+2=2+1+1=1+2+1=1+1+2=1+1+1+1$$

we have $B_4=8$, $B_4^{(3)}=7$, $B_4^{(2)}=5$, $B_4^{(1)}=1$. It is known that $B_n=2^{n-1}$, n itself being taken as one of the partitions.

The main result proved in this paper is theTHEOREM: Given the positive integer S, there exists a uniquely determined positive number $\alpha=\alpha(s)$, $\frac{1}{2}<\alpha<1$, such that

$$B_n^{(s)} \sim k/\alpha^{n-s}, \ldots\ldots \qquad \text{(A)}$$

where
$$k = k(\alpha) = (1-\alpha)/\alpha^2[2-(s+1)\alpha^s].$$

It is interesting to observe that $B_n^{(\infty)}=B_n=2^{n-1}$ and $\alpha\to\frac{1}{2}$, $k\to1$ when $S\to\infty$, *i.e.* the righthand side of (A) tends to B_n when $S\to\infty$.

4. Gibbs Phenomenon for Nörlund Means

B. N. Prasad *and* J. A. Siddiqi, Patna.

Let $f(x)$ be function of the class $L(0, 2\pi)$ and let its Fourier Series be

$$\tfrac{1}{2}a_0 + \sum_{n=1}^{\infty} (a_n \cos nx + b_n \sin nx)$$

with the partial sum

$$S_n(x) = \tfrac{1}{2}a_0 + \sum_{\nu=1}^{n} (a_\nu \cos \nu x + b_\nu \sin \nu x).$$

If $N_n^p(x)$ denotes the n-th Nörlund means of the sequence $\{S_n(x)\}$ where

$$N_n^p(x) = \frac{1}{P_n}\sum_{\nu=0}^{n} p_{n-\nu} S_\nu(x),$$

we say that the Nörlund means exhibit the Gibbs Phenomenon at the point $x=x_0$,

$$\underline{\lim}_{x\to x_0,\, n\to\infty} N_n^p(x) < \underline{\lim}_{x\to x_0} f(x) \leq \overline{\lim}_{x\to x_0} f(x) < \overline{\lim}_{x\to x, n\to\infty} N_n^p(x).$$

If the Phenomenon does not occur, we have

$$\underline{\lim}_{x\to x^0} f(x) \leq \underline{\lim}_{x\to x_0, n\to\infty} N_n^p(x) \leq \overline{\lim}_{x\to x_0, n\to\infty} N_n^p(x) \leq \overline{\lim}_{x\to x_0} f(x).$$

Gibbs Phenomenon has been discussed by a number of previous writers. In this paper we have studied the Phenomenon for the Nörlund means. In particular we, have investigated conditions under which Gibbs Phenomenon would not occur.

5. On the Determination of the Jump of a Function by Nörlund's Means

B. N. Prasad *and* J. A. Siddiqi, Patna.

Let $f(x)$ be a function integrable (L) and periodic with period 2π. Let the series conjugate to the Fourier Series corresponding to the function $f(x)$ be

$$\text{(A)} \quad \sum_{n=1}^{\infty} (b_n \cos nx - a_n \sin nx) \equiv \sum_{n=1}^{\infty} C_n(x).$$

If there exists a $D(x)$ such that

$$\text{(1.1)} \qquad \psi(t) = f(x+t) - f(x-t) - D(x) = 0(1),$$

as $t \to 0$, then $D(x)$ is called the jump of the function $f(x)$ at the point x. Even when (1.1) does not hold, $D(x)$ may satisfy either the relation

$$\text{(1.2)} \qquad \psi(t) = \int_0^t |\psi(u)|\, du = 0(t)$$

or still more generally the relation

$$\text{(1.3)} \qquad \psi_1(t) = \int_0^t \psi(u)\, du = 0(t).$$

In each of these latter cases $f(x)$ will be said to have a generalized jump $D(x)$ at the point x.

Employing one or other of the various methods like Cesàro, Riesz, logarithmic, and Abel summabilities and using partial sums of the series (A), the problem of the determination of the jump of a function has been investigated by a number of writers including Fejér, Csillag, Szidon, Lukàcs, Zygmund, Szász, Maruyama, Chow, Minakshisundaram and Misra.

In this paper we obtain several theorems using Nörlund's method of summability. We also investigate the condition under which the generalized jump $D(x)$ defined by (1.3) vanishes. It will be found that many of the previously known results are included in the theorems we have established in this paper.

6. Hypergeometric Summability Involving Infinite Limits

S. K. Basu, Calcutta.

The *hypergeometric summability* of summing a divergent series was introduced by Garabedian and Wall [Trans. American Math. Soc. 1940, 48 (185-207)] as a special type of *Hausdorff summability* [Hausdorff, Math. Zeit., 9(1921), 74-109]. In the present note is considered hypergeometric summability involving infinite limits. Thus if (H, α, 1, $\gamma+1$) denotes the hypergeometric method of summability and (C, γ) the Cesàro method then it is proved that, for a sequence $\{s_n\}$,

$s_n \to l$ (H, α, 1, γ) implies $s_n \to l$ (C, γ) $(-\infty \leqslant l \leqslant \infty)$ $\alpha > 1, \gamma > 0$, the case for l finite being already known. Eight other results of this type have also been proved.

7. On Entire Functions of Infinite Order

S. M. Shah, Aligarh.

Let $f(z)$ be an entire function of infinite order and let $\nu(r)$ denote the rank of the maximum term of $f(z)$ for $|z| = r$. In this paper I have proved the

Theorem: *For every entire function of infinite order*

$$\liminf_{r \to \infty} \frac{\log M(r)}{\nu(r)} = 0 .$$

I have also proved that this is a best possible result

8. Gases with a Pressure-Density Relation: Impossibility of Confocal Distributions

N. L. GHOSH, Calcutta.

The present paper contains a proof of the theorem that a mass of gas in which the pressure depends entirely on the density cannot have a distribution of density in confocal ellipsoids when it rotates steadily about an axis of symmetry. The author in two previous papers has proved the impossibility of density distributions in similar ellipsoids under identical circumstances. The method of proof followed in this paper, as in the case of two earlier ones, is entirely new and the results follow from the inconsistency of such distribution with Poisson's equation together with the equations of motion. Besides, the author does not use the potential function for ellipsoidal stratifications as have been done by all previous workers (Hamy, Veronnet & Dive); as such, the present results hold for any gravitational fields including external fields; moreover as no boundary conditions have been made use of, the impossibility of such stratifications must hold everywhere and consequently the conclusions arrived at in these papers are much more general than those obtained before.

9. Compressible Shear Flow—a Variational Principle

V. R. THIRUVENKATACHAR, Bangalore.

The notion of shear flow, discussed by H. S. Tsien in the case of an incompressible fluid, was extended to compressible fluid flow in a previous paper, where a condition characterising the flow was derived. In this note it is shown that the fundamental equations governing the flow may be derived from a variational principle analogous to the one developed by Lin & Rubinov for steady iso-energetic flows. It is shown further that, with the Kàrmàn-Tsien approximation, the integrand may be transformed into an expression which is identical with the corresponding expression in the iso-energetic case.

10. Some Simple Problems of a Thick Conical Shell

B. SEN, Calcutta.

Stresses in a solid cone due to a force or a couple acting at the vertex were determined by Mitchell (1900) and Ghosh (1936) respectively. In this paper a different but more direct method is employed to find symmetrical stresses in a shell bounded by two co-axial conical surfaces having the same vertex. These stresses are assumed to be caused by either an axial force applied at the common vertex or a couple operating at the same point, the axis of the couple coinciding with that of the shell.

11. An Inversion Formula for the Generalised Laplace Integral

R. S. VARMA.

The object of this paper is to give an inversion formula for the generalised Laplace Integral. This is the sixth formula of the type, three were given by the author a year & half back and two other inversion formulae were given by Mr. K. M. Saxena.

12. Inversion

SAHIB RAM MANDAN.

Certain properties of twelve circles of anti-similitude of four circles two at a time are obtained from some simple properties of a triangle by Inversion which may be enumerated as below:

(i) Four sets of 6 circles in each set consisting of 3 externals and 3 internals have a common orthogonal circle.

(ii) Four ets of 6 circles in each set consisting of three internals and three externals concur.

(iii) Four sets of 6 circles in each set consisting of all externals or two externals and four internals concur

13. On Summability [R, 1] of a Fourier Series

U. N. Singh, Allahabad.

Let $f(t)$ be a periodic function with period 2π, and of the Lebesgue class L, and let the Fourier series of $f(t)$ be

$$(1) \qquad \tfrac{1}{2} a_0 + \sum_{n=1}^{\infty} (a_n \cos nt + b_n \sin nt) = A_0 + \sum_{n=1}^{\infty} A_n(t).$$

Put $S_n(x) = A_0 + \sum_{\nu=1}^{n} A_\nu(x)$, and $\phi(t) = \tfrac{1}{2}\{f(x+t) + f(x-t) - 2S\}$. The following theorem has been proved :—

THEOREM: *If for some x*

$$(2) \qquad \int_0^t |\phi(u)|\, du = 0\left(t \log \frac{1}{t}\right), \text{ as } t \to 0,$$

and

$$(3) \qquad \int_t^c \frac{\phi^2(u)}{u^2}\, du = 0\left\{\left(\log \frac{1}{t}\right)^2\right\}, \text{ as } t \to 0,\ 0 < c \leqslant \pi$$

then

$$\sum_{\nu=1}^{n} \frac{|S_\nu(x) - S|}{\nu} = 0(\log n).$$

i.e. the series (1) is summable [R, 1] to S at $t = x$.

14. Differentiation of composite functions

N. Misra, Cuttack.

15. Mixed partial Derivatives of composite Functions

N. Misra, Cuttack.

37th INDIAN SCIENCE CONGRESS, POONA 1950.

SECTION OF STATISTICS

Abstracts

1. Unbiassed Statistics with minimum variance.

A. BHATTACHARYYA, Calcutta.

Aitken and his school studied the problems of the existence and determination of unbiassed statistics with minimum variance. The author, approaching the problem from another angle, obtained much more general results. In this paper, the author's own results have been further extended.

2. On the construction of Incomplete Probability Integral tables of the classical D^2-statistic.

P. K. BOSE, Calcutta.

Author in a paper in Sankhya vol. 8(3) published a set of tables containing the 99%, 95%, 5% and 1% values of L (a transformed variate of D^2) for some specified values of p and Δ^2. It is well known that as p and Δ^2 increase the distribution of classical D^2 statistic tends towards normal. In this paper an attempt has been made to find out for each value of Δ^2 the value of p for which the distribution of D^2 statistic may be taken to be identical with the normal curve for all practical purposes.

3. On the moments of the non central Chi-square distribution.

M. C. CHAKRABARTI, Bombay.

Let $x_1, x_2, \ldots, x_n$ be n independent Stochastic variates having normal distributions with means $\mu_1, \mu_2, \ldots, \mu_n$ and a common standard deviation σ. Then the statistic $\chi'^2 = \sum_{i=1}^{n} x_i/\sigma^2$ is known as non-central chi-square. In the paper (i) the distribution law of χ'^2 has been derived by using the method of characteristic function, (ii) the moments about the origin have been obtained in terms of a finite hypergeometric series and an elegant recursion formula has been obtained which will enable one to calculate from a known moment the higher and lower moments, (iii) a recursion formula has been obtained for moments about the mean. The recursion formulae obtained are believed to be new.

4. A proposed new index of health.

M. W. CHIPLONKAR, Poona.

At present there does not exist any satisfactory and universal index of health or physical fitness to guide the selection of candidates most suitable for the different civil and military services. The formulae in use are more or less incapable of correctly appraising all the merits and defects which are usually present in a variety of combinations in the examinees. In the present paper a new and sufficiently simple formula has been proposed for the index of physical fitness, J, which not only takes into account all the physical measures of the individual but also the differences of age, sex and race. The formula provides a universal index of physical fitness. It is: $J = L - D/L$, where, L is a function of the various active (or living) elements and D, that of the various inactive (or dead) elements of the individual and are given by the following relations:—

$$D = a_1 d_1^2 + a_2 d_2^2 + \ldots\ldots\ldots + a_n d_n^2.$$

$$L = b_1 l_1 + b_2 l_2 + \ldots\ldots\ldots + b_n l_n.$$

where $d_1, d_2, \ldots d_n$ are the variations of the different physical measures of the individual from the respective class averages, $l_1, l_2, \ldots l_n$ are the variations of the different performances of the individual from their respective class averages, and $a_1, a_2, \ldots a_n$ and $b_1, b_2, \ldots b_n$ are the various corresponding constants representing the relative weights attached to each of the physical measures and performances. It is important to note that besides possessing many other merits the formula clearly differentiates between the active and the inactive elements of an indvidual. The method of using the formula and the choice of the constants involved are described. Typical cases are cited to show its utility.

5. On Systematic Sampling.

A. C. Das, Calcutta.

In one dimensional systematic sampling, defined after Cochran, and taking ν cells from each stratum, even if the strata have got different means but same variance, systematic sampling is more efficient than stratified random sampling if the correlogram be concave upwards.

The best unbiassed linear estimate of $\Sigma l_i \mu_i$ is $\Sigma l_i x_i$ where μ_i is the population mean and x_i the sample mean of the ith stratum, and l_i's are known constants.

Assuming multivariate normal distribution, the maximum likelihood estimate of λ, for $\rho_u = e^{-\lambda u}$, has been found out.

In two dimensional systematic sampling, defined by the author, even if the strata have got different means but same variance, systematic sampling is more efficient than stratified random sampling if the following relations hold good: (i) $\delta_1^2 \rho \ (u, v) \geqslant 0$, ii) $\delta_2^2 \rho \ (u,v) \geqslant 0$, where δ_1 and δ_2 are usual central difference notations for u and v respectively.

6. Use of Eye Estimates for Crop Forecasts.

D. M. Ganguli, Calcutta.

Crop forecasts prepared on the basis of eye-estimates or guess-estimates have been severely criticised by many. This is probably because in most of the cases these estimates were neither collected through reliable agencies nor were proper precautions taken in their collection for it is a well known fact that the jute mill owners of Calcutta prepare quite reliable estimates of the jute crop on the basis of guesses made by their trained staff.

An experiment was conducted in 1948 in West Bengal to test if guess estimates were of any value in case of Aman paddy. Estimates as compared to the previous years crop were collected from educated cultivators for the purpose. Before they were requested to give their estimates they were asked several other questions regarding the factors that influence the extent of cultivation and the growth of the crop (such as availability of seeds, human labour and bullock labour, weather condition, damage of crops by insects etc.) and were asked to revise their estimates when contradictory statements were given.

On comparison of these guess-estimates with sample survey estimates it was found that the area estimates were quite reliable while the yield estimates were not so.

7. On stratification with Component indices.

A. Ghosh.

Stratification of rural areas with the method of component analysis considering a number of the more important characters have been carried out. It has further been shown that the highest principle component calculated is highly correlated with a comparatively simpler index arrived at from a consideration of the distribution of area owned and area cultivated in that region.

8. Multi stage Stochastic Models for Natural Fields.

Birendranath Ghosh, Calcutta.

General descriptions of such models have been given earlier (*e.g.*, *Cal. Stat. Assoc. Bull.* 2(5), 22-25; *Science and Culture*, 9, 213-14). Such models can be classfied as a special type of *stochastic processes* on multi-dimensional fields; a $(k+1)$ stage field is supposed to be sub-divided successively in *blocks* of smaller and smaller sizes, the i-th order block, B_i, containing a number of smaller B_{i+1} blocks ($i=0, 1, 2, \ldots, k+1$), B_0 denoting the whole field (or *stratum*), and B_{k+1} the ultimate basic cells. The value of the variate $u=\sum_{0}^{k} \alpha_i$, the α's being mutually independent, and α_i being constant for any B_i, but varying randomly from one B_i to another inside a B_{i-1}; $E(\alpha_i)=0$, $E(\alpha_i^2)=\sigma_i^2$, excepting, α_0, which is a constant. Methods for working out the *topographic* or *spatial correlation* for the general N-dimensional $(k+1)-$stage fields have been indicated, and some expressions for the general case and a few particular cases have been worked out. (The expression being somewhat lengthy are not given in this abstract).

Furthermore, the methods for working out the variances and covariances of generalised "rectangular" sample-units have been indicated, using the extensions of some results for distributions of random distances inside a rectangle and between two rectangles (*Cal. Stat. Assoc. Bull.* 2 (5), 20; *Science and Culture* 8, 388 & 464). The expressions for such variances and covariances have also been worked out in some special cases.

9. Distribution theory of runs up and down.

P. V. KRISHNA IYER, New Delhi.

It has been shown that the cumulants for the distributions of the number of runs up and down when n different numbers are arranged at random on a line can be obtained by using the theorem that the rth factorial moment is $r!$ multiplied by the expectation for obtaining r runs.

10. Further contributions to the theory of probability distributions of points on a line.

P. V. KRISHNA IYER, NEW Delhi.

The moments and the difference equations satisfied by the moment generating functions of some distributions that arise from m points possessing one of k characters or colours arranged at random on a line have been considered in this paper. The distributions considered are (i) the number of joins between adjacent points of the same or different colours; (ii) the total number of runs of length s or more of one as well as two specified characters. It has been shown that all the distributions considered, excepting in cases where the probability of the points assuming a specified character is very small, tend to the normal form when m tends to infinity.

11. A Statistical note on the technique of sampling of Sugarcane for chemical analysis.

S. S. IYER, Shahjahanpur.

Sampling data for chemical analysis of cane juice from five field experiments (2 Varietal trials and 3 Manurial trials) carried out at Shahjahanpur in 1943-44 and 1944-45 have been statistically studied with particular reference to sampling technique. On the average, by taking 2 one-foot length of cane as a sampling unit and 2 such units from each plot, differences of the order of 5.3% in expression 1.2 in brix %, 1.3 in sucrose % and 2.4 in purity could be distinguished at 1% level. Sampling variation in general formed the major part of experimental error emphasizing the importance of increasing the number of samples per plot if precision is to be increased. In Varietal trials however for brix and sucrose estimation plot to plot variation was also considerable. This indicated the need for separate sampling from each replication. Number of plots required for estimating mean sucrose different percent standard errors have also been calculated.

12. A new approach to the system of Weightage attached to different commodities in calculating the Index Number of Retail Prices of Food Grains.

GOPAL PRASAD KHARE, Rewa.

Various Governments are publishing index numbers of retail and wholesale prices. They have got different system of weightage but none of these systems reflects the true economic effect of prices over people. In the present instance we have been collecting market prices and the figures of actual sales for different food grains since the beginning of this year. These prices were then averaged by attaching to them weights according to their sales. Subsequently with the average for the month of January as base index numbers were calculated for different weeks. Later on we conducted Family Budget Enquiry of the peons of the Vindhya, Pradesh Government Secretariat and the Cost of Living Index Numbers for food group only were calculated for different weeks with January as base. As many as 156 family budgets were taken into consideration and the Cost of Living Index Numbers and the index number of retail prices for 35 weeks were obtained. There exists a high degree of correlation (.912) between two index numbers. So it seems that this system of weightage in calculating the index numbers of prices gives us the effect of prices over the economic condition of people. A further study of problem may give very interesting and useful results.

13. Non-response Bias in Mail Enquiries.

N. T. MATHEW

The percentage response in mail enquiries is usually found to be low and rarely higher than 50. It is therefore of importance to know whether in relation to specific enquiries the responding section of the sample is representative of the whole sample. In mail enquiries for obtaining information about listener preferences to alternative programmes non-response can be ignored only if either the non-respondents are also non-listeners or if the preferences of the non-respondents are not materially different from those of the respondents.

In this paper which is based on data collected during an enquiry conducted in Madras City by the All India Radio it is shown that non-response bias is not as important as it is usually believed to be. Out of 900 enquiry forms sent out by post 360 replies were received. The percentage of listeners was 84 among respondents, and 70 in a sample of non-respondents who were followed up with personal interviews. The preferences of the respondents and non-respondents were not significantly different in most cases, and even when statistically significant the differences were not of any practical importance.

14. Certain Results on the Roots of a Determinantal Equation with two Roots.

D. N. NANDA, Kanpur.

In this paper the author has described some results on the roots of a determinantal equation. A few results already obtained by the author are also listed. The probability distribution table for a root of the determinental equation is worked out by the author and a reference is made to that. The analogy of F and roots of a determinantal equation is illustrated in the analysis of variance and covariance. The distribution of the sum of roots under null case is derived. The distribution of covariance under non-null case is also discussed. Some further problems in this field are enumerated.

15. A Note on Multipurpose Sampling.

D. N. NANDA, Kanpur.

This note discusses the theory of Multipurpose Sampling. A linear model is set up to reduce the multivariate study to a univariate one. The efficiency of sampling on such a model is discussed in detail for different types of sampling procedures. The application of this model to cost of production surveys is also discussed. The application of Cochran's extension of general theory for optimum cost and optimum accuracy in cost surveys is also explained.

16. A Note on combination of tests of significance.

H. K. NANDI, Calcutta.

When a number of independent tests of significance have been applied in a particular situation, it sometimes so happens that the actual probabilities, though none declares significance, might be small enough to point out the need of pooling these results. For such combination of tests of significance Fisher suggested a χ^2 — test which is not, obviously, based on any consideration of the alternative hypotheses that may be true. In this note a study has been made of this problem of combination of tests of significance from the point of view of Neyman's ψ^2—test. It is found that (i) under certain conditions the sum of the observed probabilities (which are rectangularly distributed on the null hypotheses) supplies a test criterion which is most powerful, (ii) under certain other conditions the sum of squares of the observed probabilities gives rise to a test which has some optimum properties. It is interesting to note that if the observed probabilities are not much different, the test (i) and Fisher's χ^2 are nearly equivalent provided the proper tail-end of the χ^2—distribution is chosen.

17. Efficiency of certain linear systematic statistics for estimating dispersion from Normal Samples.

K. R. NAIR, Dehra Dun.

If $x_1, x_2, \ldots x_n$ is a random sample of n observations arranged in ascending order of magnitude the linear systematic statistic

$$j_{(r)} = (x_n + x_{n-1} + \ldots + x_{n-r+1}) - (x_r + x_{r-1} + \ldots + x_1)$$

where $1 < r < \frac{1}{2}n$ or $\frac{1}{2}(n-1)$, according as n is even or odd, is shown to be more efficient that the mean deviation from mean, the mean deviation from median, and the range, for samples of size $n=6$ to 10 drawn from a normal population. The most efficient among the statistics of the j— group is $j_{(2)}$ for these sample sizes.

It is also shown that Gini's mean difference is more efficient than $j_{(r)}$. The former however involves a little more computation than the latter.

18. Covariance analysis when the effect of the concomitant variates differs from group to group.

R. D. NARAIN, New Delhi.

In the usual procedure to adjust the observed values of a random character for the effects of one or more concomitant variates, and to test the significance of the differences in the adjusted mean values of two or more groups, it is assumed that true values of the regression coefficients of the concomitant variates on the variate under study do not differ from group to group. The homogeneity of these coefficients can of course be tested, but to the author's best knowledge no procedure has so far been indicated, in case the regression coefficients significantly differ from one another. In this paper the modifications necessary in such a situation have been worked out with full details of the arithmetical computations.

19. On the Unbiassedness of Statistical Tests in the Normal Theory.

R. D. NARAIN, New Delhi.

In earlier papers (1948 J.I.S. Agr. Stat. Vol. I pp. 59-69, 137-146) the author has shown how by splitting the multivariate normal density factor into a chain of conditional distribution densities, a simple and unified procedure can be developed which yields the distributions, null as well as a non-null, of almost all the well-known statistical coefficients relevant to the normal theory. The present paper further extends the scope of the method by showing that exactly the same principle, that of working with a chain of conditional distributions, can be used to show in a very simple manner, even without an explicit knowledge of their frequency functions, the completely unbiassed character of tests associated with these coefficients.

In this manner Wilks criterion for the independence of two sets of variates as well as that for the independence of any number of sets of variates are shown to be completely unbiassed. These results are new.

20. A Pitman Test for Multiple Correlation.

R. D. NARAIN, New Delhi.

A test of significance of the multiple correlation coefficient R between a variate y and a set of p variates $x_1, x_2, \ldots x_p$ can be developed in the sense of the test given by Pitman for the simple correlation coefficient. The population envisaged comprises

the N! (where N is the number of observations) permutations of the values of y with those of $x_1, x_2, \dots x_p$. The first two moments of the distribution of R^2 have been worked out.

21. A Characterization of the Multivariate Normal Distribution.

R. D. NARAIN, New Delhi.

Kaplansky (1943, Ann. Math. Stat. 14, 197) has shown that if the product

$$\overset{n}{\underset{i=1}{\pi}} \; f(x_i)$$

is expressible in terms of the mean and the standard deviation only, $f(x)$ is normal. As a generalization to the p—variate case, it can be shown that if

$$\overset{n}{\underset{i=1}{\pi}} \; (f(x_{i1}, x_{i2} \dots x_{ip})$$

is expressible entirely in terms of the variances, covariances and the means of the p variates, $(n > p+1)$

$$f(x_1, x_2 \; \dots x_p)$$

must be of the p--variate normal form. The proof consists of first showing that the conditional distribution of any one of the p-- variates is normal and hence the final esult.

22. Optimum size of plots for field experiments on some crops by a new approach.

D. P. PANDAY, New Delhi.

The best size of plots for field experiments on various crops is generally determined on the basis of the coefficient of variation for different plot sizes as obtained from uniformity trial data. In this paper the size of plots for experiments on sugarcane, wheat, barley and lentil has been found on the basis of validity of the error, i.e., by examining whether the distribution of yields of the plots becomes random for any particular plot-size. On this consideration, the best plot size for experiments with the above crops is as given below :—

Sugarcane—10/242 acre ; wheat—25 × 25 sq.ft.
Barley—10 × 16 sq.ft., lentil 20 × 20 sq.ft.

23. A Note on the application of maximum likelihood to factor analysis.

D. V. RAJALAKSHMAN, Madras.

The variation in scores between students in performance tests is attributed to the presence of various general factors in addition to the specifics. In multi-factor analysis where 'r' general factors are present, the loadings of the tests with these factors are determined on the criterion that $(r+1)$th order minors of the correlation matrix should vanish. Since it is laborious in practice to find the order of the minors vanishing within the limits of sampling error, iterative processes have been developed for arriving at approximations of diagnol elements (communalities) of the matrix which, otherwise, must be determined by using the above criterion. In addition to the methods suggested by Thurstone and Thomson an iterative process of arriving at approximation is possible by making use of the theory of maximum likelihood.

All these methods have been applied in this paper to study the marks of candidates that took the secondary school leaving certificate examination. A random sample of 841 students is chosen from the 56,092 candidates that sat for the examination with the help of random numbers prepared by Kendall and Smith. The marks of these candidates are analysed and loadings are calculated using the method of maximum likelihood. These results are compared with the approximations arrived at by applying the processes suggested by Thurstone and Thomson for the same data.

24. On a Limit Theory in the Theory of Probability.

K. S. RAO, Bombay.

The First and Second Limit theorems are well-known in the theory of probability distributions. Necessary and sufficient conditions that a sequence of distribution function $F_n(x)$ may tend to a distribution function $F(x)$ are given in terms of the characteristic functions or of the existence and convergence properties of the moments of $F_n(x)$. Sufficient conditions are the important parts of both the theorems. In this paper sufficient conditions for the convergence of sequence $F_n(x)$ to a distribution function $F(x)$, expressed directly in terms of $F_n(x)$ without an appeal to either characteristic functions or moments, are discussed.

25. A Note on Wilks Statistic.

K. V. R. SASTRY, New Delhi.

To the author's best knowledge, all the authors deriving the Noncentral T^2--Distribution have been employing the invariance property of T^2. To investigate if some properties of interest are covered under the simplicity effected by the above property, the distribution was derived without assuming this property.

Wilks criterion for two sets of variates ($k-1$ and p) is a generalisation of the multiple correlation coefficient. When the set containing ($k-1$) is fixed and the other set follows a multivariate normal law, the criterion turns out to be the likelihood ratio statistic to test the hypothesis of equality of means for k p-variate samples. We have taken up to investigate into the nonnull distribution of this criterion for $k=3$ and worked out the distribution :

(i) when the set of $k-1(=2)$ is fixed and the second set follows a multivatiate normal law and (ii) when the second set is fixed.

It is very interesting to find that the duality between the distributions under the two cases which exists for R^2 (*i.e.*) $k=2$ is absent here.

It appears this approach to the problem of testing the homogeneity of means shows the completely unbiassed character of the test and this is under investigation.

26. Comparison of 'Overall Tests' & 'Individual Tests'.

DAROGA SINGH, New Delhi.

In problem of testing a hypothesis concerning the vanishing of more than one parameter, the test can be made in two ways, either we may test the vanishing of each parameter separately or simultaneously, the former may be called 'Individual Tests' and the latter may be called 'Overall Tests.' Under the first category we may include tests based on student's t and total and partial correlation coefficients and under the second category we may include tests based on R, multiple-correlation coefficient, F-test, Hotelling's T^2 etc.

Examples have been given showing that the two methods of approach to the same hypothesis may sometimes lead to contradictory results. The entire sample space giving such contradictory results has been completely mapped out by means of graphical representation. The power functions of the two tests have also been compared. Here also the entire parametric space has been mapped out giving the second kind of error in one case less than 5% while in the other case greater than 5%. Tables have been constructed giving the required number of replications to experiments so that to have a fair chance of detecting the falsehood of the hypothesis.

27. Third and fourth moments of some probability distributions arising from points on a lattice.

B. V. SUKHATME, New Delhi.

The third and fourth moments of a number of distributions that arise from mn points possessing one of k characters or colours arranged at random on a rectangular lattice consisting of m rows and n columns, are derived in this paper. The distributions considered are (i) the number of black-black joins, (ii) the number of black-white joins and (iii) the total number of joins between points of different colours. Results have been obtained both for free and non-free sampling. The joins considered are those along mutually perpendicular axes including the diagonal joins. The distributions tend to the normal form when m and n tend to infinity.

28. On certain probability distributions arising from points on a line.

B. V. SUKHATME, New Delhi.

The paper deals with certain probability distributions arising from m points, possessing one of k colours arranged at random on a line. Two separate cases have been considered. They are free and non-free sampling. In free sampling the chance of a point taking the rth coour is p_r such that $\Sigma p_r = 1$. In non-free sampling the number of points of each colour is fixed in advance say n_1 black, n_2 white etc. such that $\Sigma n_r = m$. The distributions considered are (i) total number of joins between points of different colours (ii) the distributions of triplets, quadruplets, and r-plates (iii) number of runs of length r. The cumulants for all these distributions have been shown to be linear expressions in m. It has also been shown that the distributions tend to the normal form when m tends to infinity except in the case when the probability of the points taking a particular colour is very small. In the latter case the distributions tend to the poisson form.

29. Methods of Stratification of rural population.

A. GHOSH *and* H. K. CHATURVEDI, Calcutta.

In this paper attempt has been made to stratify the rural population by a study of the interrelationship of the character considered important in rural economy. Several methods have been tried like study of the partial regression coefficients of the different characters for different groups, and D^2 indices, etc.

30. An Investigation into Age-Bias in Census Returns.

S. S. NAIR, Calcutta.

This paper deals with a study on 1941 Census sample slips for certain districts, with a view to investigate into the nature and extent of bias in age, when recorded correct to the month. It has been found that a large proportion gave zero entries under month and this proportion was independent of sex, literacy and community classifications. Even in cases where entries were to the nearest month a definite bias towards years ending with 0, 5 etc. was noticeable; this digital bias, however, was less in such cases. Bias for some particular digits was also studied in greater detail under several classifications.

31. Some Studies into the size of Family in West Bengal.

N. C. DUTTA, Calcutta.

This investigation is based on the 2% sample slips of the 1941 Census—extracted at the instance of the Census Commissioner. This is mainly a study into community and literacy differentials in relation to the average number of children born to the married women in different age groups. The relationship between the age of mother at birth of first child and the size of the family is also investigated into.

The nature of the misstatement of age of married women is also studied on the basis of the average number of children born to women in different ages as reported

32. On Certain Charts Useful in Quality and Effiency Control Methods.

ABRAHAM MATTHAI, Calcutta.

In the application of statistical control chart methods certain assignable causes are often met with which though detected and measured have to be reconciled with, e.g. fatigue factor in production over a period of time. One method in such situations is to use modified control limits. A more general case arises when the different values observed of a variable are under the effect of several known causes. In this paper certain charts are discussed in which avoiding numerical calculations the values are made comparable and plotted directly on the chart. The use of certain standard scales and nomograms is suggested.

Also in this paper has been indicated the application of the theory of runs or sequences as a powerful means to arrive at rates of the type met with in cost-accounting.

33. On Methods of Handling Algebraic Signs on the Hollerith Multiplier.

ABRAHAM MATTHAI, Calcutta.

Two methods are evolved in this paper by which algebraic signs of factors are taken into account during multiplying operations on the punched-card (Hollerith) multiplying machine. The property is made use of that the products: $1 \times 1 = 1$, $1 \times 9 = 9$ and $9 \times 9 = 81$ or the sums $0 + 0 = 0$, $0 + 5 = 5$ and $5 + 5 = 10$, are in agreement with the laws of multiplication of signs, namely $(+) \times (+) = (+)$, $(+) \times (-) = (-)$ and $(-) \times (-) = (+)$. The use of numbers (called designations) 1 and 9 or 0 and 5 for + and − signs respectively together with plugging on the machine as described, enable the signs of the factors to take care of themselves during the operations and permit the products to be prefixed with their appropriate signs.

34. A Comment on Spurious Correlation.

M. V. JAMBUNATHAN, Calcutta.

In a paper with the above caption, Herman Wold, (Uppsala, 1946) has underlined the important fact that regression equations sometimes give a false picture of the dependance of a variable factor in its causal dependence on other factors. He has established in his paper a result which serves as an illustration of the fact that, though satisfying rigorous or refined significance tests, these regression coefficients are not always to be relied upon as showing the inter-dependence of the variables, unless corroborated by a non-statistical judgment of the data. The present paper furnishes a simple and direct proof of Wold's result without recourse to Jacobi's parametric representation of a positive definite matrix. As an extension of Wold's result, the following theorem is also deduced.

"Given a set of stochastic random variables, say $x_1, x_2, \ldots x_n$ there exists, under certain conditions, a stochastic variable x_{n+1} wholly uncorrelated with x_1 such that the partial regression coefficients of x_1 with $x_2, \ldots x_n$ may be made respectively equal to preassingned constants."

35. Properties of Beta Distributions.

M. V. JAMBUNATHAN, Calcutta.

Certain interesting properties of stochastic variates following the Beta distributions (of the first kind as well as of the second kind) are studied in this paper, and the results are applied to deduce the distribution of Hotelling's generalised T or the studentised D^2 statistic under the null hypothesis.

36. Use of Differences in the Evaluation of Sampling Variances.

M. V. JAMBUNATHAN, Calcutta.

The determination of the variance of an estimate plays an important part in the theory of estimating a population parameter from a sample, for the reliability or precision of the estimate is judged by its variance or its standard error. The method of differentials has been widely employed by statisticians in calculating the standard errors of moments and other statistics, the approximations usually employed being of the order of $n^{-\frac{1}{2}}$. The same method has also been profitably used in variate transformations so as to make the new variates conform (more or less closely) to the normal distribution. To obtain exact results which alone can be used in the case of small samples, the above method is found to be unsuited.

The method of differences suggested in this paper gives exact values of the standard errors of certain statistics. Several illustrations are given and the method applied to evaluate the standard error of the estimate of a character when the estimate is obtained by the type of sampling known as 'double sampling.'

37. Suggestions Regarding the Questionnaire form for the 1951 Census.

P. K. MUKHERJEE, Calcutta.

Mistakes in the actual data collected in 1941 Census have been investigated from a study of Y-slips. It has been found that nearly 40 p.c. of the data is not reliable. In the light of the above investigation, suggestions have been made to revise the questionnaire form so far as (i) number (ii) exact wording (iii) arrangement of the questions, as also (iv) incorporation of new informations, are concerned,

37th INDIAN SCIENCE CONGRESS, POONA, 1950.

SECTION OF PHYSICS

PRESIDENT : DR. R. N. GHOSH, D.Sc., F.N.I., F.A.S (America)

Abstracts

Theoretical Physics, Nuclear Physics

1. Thompson Scattering and the Hole Theory.

D. S. KOTHARI *and* F.C. AULUCK, Delhi.

It is well-known that the 'Original' Dirac Theory and the 'hole' theory - though they give different expressions for self energy--give the same value of the scattering cross section (Klein—Nishina formula). It is shown here that if the scattering electron belongs to a degenerate electron gas, the scattering cross section is affected differently for the 'Original' theory and the hole theory. In the case of Thompson scattering whereas on the 'original' theory the scattering cross section remains practically unaffected it is not so on the hole theory. In the case of hole theory, the scattering cross section tends to vanish for photons of wave length λ_0, where λ_0 is the minimum de-Broglie wave length for the Fermi-distribution for the degenerate electron gas.

2. On new Partition Formulæ.

F. C. AULUCK *and* K. S. SINGWI.

Using the method of statistical thermodynamics Kothari and Auluck during recent years have been able to deduce certain new partition formulae which are difficult to handle by analytical theory. We have been able to deduce formulae for the numbers of partitions of a large integer n into smaller integers and half odd integers, such that each summand is either not repeated at all or is allowed to repeat only odd number of times, and (i) in each partition the "types" of summands is exactly N and (ii) when there is no restriction on the number of "Types."

3. The Long Period Activities of Radiosilver.

N. K. SAHA *and* K. GOPALKRISHNAN.

The two long period activities, 24.5 minutes and 8.2 days, of radiosilver are developed by irradiation of the silver cathode of a Geiger-Müllar Counter by a mixture of fast and slow neutrons. For irradiation a 100 milligram Ra + Be-neutron source is placed alongside the counter inside a 10 cm thick lead enclosure surrounded on all sides by a layer of paraffin wax 5 cm thick. The G.M. counter records its own activity. In addition to the well known intense activities of 22 sec. and 2.3 min. periods of Ag, the two long period activities, due to the isomer Ag 106, are also produced with measurable intensities by the reaction Ag 107 (n, $2n$) Ag 106. Results of some of the preliminiary measurements are reported here.

4. On quick apparently adiabatic homologous radial motion of stars.

G. BANDYOPADHYAY, Darjeeling.

It has been proved in this note that a quick 'apparently adiabatic' (a term which simply implies

$$\frac{P}{P_0} = \left(\frac{S}{S_0}\right)^{\delta}$$

$\delta \neq c_p/c_v$)

homologous radial motion of a star is possible when:

$$\delta = \frac{4}{3}$$

and the law of opacity and subatomic energy generation are of the form:

$$K \infty \left(\frac{S}{T^3}\right)^{\alpha} T^{-\frac{5}{2}}$$

$$\varepsilon = \left(\frac{S}{T^3}\right)^{b} T^{\frac{5}{2}}$$

5. The theory of meson and its interaction with Nuclear Particles.

R. C. Majumdar, Delhi.

The fundamental equations of meson field were originally obtained by Yukawa and Proca as a generalisation of the electromagnetic field equations and its interaction with nuclear particles was introduced with the help of the 4-vector potential of the field. The spin of the meson was expressed as a polarisation of the wave function, such that, for a meson of spin unity there are three independent states of polarisation for a given momentum, two of them being transverse and the other one longitudinal. In this wave formulation we are to perform the calculations separately for the longitudinally and transversely polarised mesons and then finally sum or average over various polarisations. As obvious, therefore, the calculations become extremely lengthy and laborious. Now since the mesons which are observed in cosmic rays are mostly charged Kemmer considered it desirable to build up a particle theory of mesons as a generalisation of Dirac's theory of electrons. In this particle formulation although the interaction of the mesons with electromagnetic field present no difficulty the calculation of their interaction with the nuclear particles, however, is not at all straightforward. In the present paper the interaction of the meson with the nuclear particles has been investigated with the help of a column vector matrix Γ first introduced by Harish Chandra which allows the calculation to be carried out in an elegant and straightforward way. The scattering of various types of mesons by the nuclear particles and the interaction between the nuclear particles themselves have been completely worked out and the results are discussed with reference to the observational data on cosmic rays.

2. SPECTROSCOPY

6. Structure of 3rd band of Iron and Magnetic and non-magnetic Iron compounds and alloys, by Soft X-ray Spectroscopy.

K. Das Gupta, Calcutta.

The structure of 3d band of Iron in the region of 17.5 A.U. corresponding to the transition of $M_{IV, V}$ electrons to the vacant $L_{II, III}$ level have been investigated by a bent mica crystal grating in Siegbahn spectrograph. $L_{\alpha_{1,2}}$ is due to the transition $M_{IV, V} \rightarrow L_{III}$ and $L\beta_1$ due to $M_{IV} - L_{II}$. $L_{\alpha_{1,2}}$ bands have been taken for pure iron, *$Fe_2 0_3$, (Fes)*, $Fe_3 0_4$, (Fes). *Fe-Si* (14%*Si*), *Fe-Si* (55%*Si*), Fe-Si (4%*Si*, Stalloy), Fe-Al 21%*Al*), *Fe-Cu*(85% *Cu*). The under lined samples being non-magnetic and the rest Ferro-magnetic. In each of the samples a broad band has been obtained, the wave-length of the peak of the band being 17, 17,565X.U. Only the band for pure iron is shifted and the wavelength of the peak is 17,572 X.U.

The most interesting observation in this investigation is the appearance of an extra band on the short wavelength side of the main 3d band in the case of samples in which ferro-magnetism has been quenched by the formation of alloys or compounds,

This extra band which is so prominent in the case of non-magnetic Ferrous alloys and compounds appears very faintly in the case of ferro-magnetic samples like pure iron, magnetite ($Fe_3 O_4$), Stalloy, (FeS).

Data so far collected point qualitatively to the fact that the intensity of the extra band detected is to be correlated with magnetic Susceptibility. The experimental results obtained have thrown much light on the present idea of 3d band structure of Ferromagnetic materials.

7. Soft X-ray Absorption and Emission Spectra of Alkali-halides.

K. Das Gupta, Calcutta.

K valence band emission spectra corresponding to the transiton of valence electrons into inner vacant K level have been taken in the case of metal ion in NaF, NaCl, NaBr, NaI with a concave Gypsum crystal grating spectrograph designed by Prof. Siegbahn. Chlorine K valence band spectra in the second order have been taken for alkali-chlorides, alkaline-earth chlorides. K absorption spectra of Na in NaF and NaCl have also been taken. Considering K absorption data of Chlorine in various chlorides of Stelling and of Na in Sodium-halides by K. C. Rule of Upsala it has been possible to draw electronic level structures of the valence electrons in such solids.

The energy diagram of valence electrons thus drawn from the absorption and emission data explains in a straightforward way the origin of the fundamental ultra-violet absorption bands of alkali-halides. A good agreement between the values of ultra-violet absorption bands as directly obtained by Hilsch and Pohl and as obtained from soft X-ray emission and absorption data of Halogen ion, as well as, of alkali ion for various halides supports the new explanation as to the origin of these ultra-violet absorption bands in alkali-halides.

8. Fluctuation of intensity in the D. C. Mercury arc.

C. K. Sundarachar, Tumkur.

An experimental study of the luminosity in the region close to the cathode of a low pressure mercury arc fed from a D.C. supply, using a vibrograph camera arrangement, reveals a variation of intensity of a period of about 0.002 seconds. The origin of this phenomenon is discussed with reference to some of the well-established characteristics in respect of the arc discharge. The view is put forward that the random motion of the cathode spot and the high velocity vapour stream from the cathode bring about the fluctuation in intensity.

9. Excitation of Nitrogen band in the sodium arc.

C. Srinivasan *and* C. K. Sundarachar, Tumkur.

It is found that the first negative bands of Nitrogen are brought out with great intensity in spectrogram of the radiation from a high current low pressure sodium arc, containing an admixture of nitrogen. The possible mechanism of the excitation of these bands in the sodium arc is discussed, on the basis of theories of the origin of nitrogen bands in the afterglow of active nitrogen and the aurora.

The view is put forward that the nitrogen bands observed in the sodium arc discharge arise from collisions of the first kind betw een ground-state $(x^1)\ \Sigma\ N_2$ molecules and fast electrons.

10. A Note on the Estimate of the Dissociation Energy of C_2 (Swan):

N. R. Tawde *and* M. G. K. Menon, Bombay.

Recently Tawde and Menon have reported some parallelism between h.p. and Swan bands of Carbon. These results, in general, go to support the hypothesis of Herzberg regarding $D(C_2)$ which he estimates as 3.6. v. According to Gaydon it is expected to, be not less than 4 e.v. Tawde from intensity observations arrives at a value 4.2 ± 0.1 e.v. Johnson and Asundi's evidence is in favour of value higher than 3.6 e.v. of Herrzberg, and this receives support from Singh. The very recent computation of Phillips giving 5.3 e.v. is considered to be high estimate. All the spectroscopic derivations take along with the estimate $D(C_2)$ 4.7 e.v. from vapour pressure and sublimation data bring the subject to an interesting stage. The note gives a critical discussion of the whole aspect.

11. Excitation of Carbon bands in Neon.

N. R. TAWDE *and* (MISS) V. RAJESWARI, Bombay.

Systematic study of the excitation of the spectra associated with carbon as an auxiliary to the spectroscopic study of combustion in flames has been undertaken. The results with argon have already been reported. This investigation relates to neon gas excitation. The spectrum reveals considerable presence of atomic lines of neon (unlike argon), the C_2 (Swan), the CH (4300) and probably the triplet bands. It is thought from the behaviour of the results that the energy transfer phenomenon is of resonant type as in argon, but less efficient.

12. A Case of Quantum Mechanical Resonance in Energy Transfer Phenomenon—CO Discharge.

N. R. TAWDE *and* M. G. K. MENON, Bombay.

It was shown in an earlier note that the selective enhancement of Swan bands in argon at a pressure of 15 mm. of Hg. was a consequence of resonance effect in energy transfer by inelastic collisions. It has been further noticed in recent investigations on CO discharge that Swan bands are brought about in it at a pressure of about 15 mm. and again in the neighbourhood of about 30 mm. with selective behaviour. The selective effects in argon as well as in CO might be interpreted in terms of migration of energy between excited and unexcited entities, so as to connect the time between two collisions with the mean radiative life-time by a quantum relation.

13. Theoretical Transition Probabilities in C_2 (Swan) Bands.

N. R. TAWDE, Bombay.

Recently King (Astrophys. J. *108*, 429, 1948) has measured the intensities of Swan bands excited in electric furnace. The results have been compared with the theoretical and experimental work of other investigators, viz. Mckellor and Buscombe and Johnson and Tawde, resp. Patel (Ph.D. thesis, Bombay, 1947) in this laboratory some years ago, has carried out the calculations of transition probabilities from Hutchisson's intensity integral. The values of some of these appear to be at considerable variance with those of Mckeller and Buscombe. Attempt is made to trace the causes of disparity and to examine the theoretical transition probabilities in terms of several experimental results.

14. Relative Resonance Distributions in D_1 D_2 Lines of Sodium.

N. R. TAWDE *and* G. K. MEHTA, Bombay.

The measure of self-reversal of the two components of sodium doublet has been obtained by resolving the lines. Each of the line shapes shows a similar resonance distribution but the absorption parameter p in the case of high frequency component of the doublet has been found to be different from that of low frequency one, indicating the ratio of the concentrations of emitting and absorbing atoms n_e/n_a to be smaller for 5890 line and thus a higher resonant effect in that wave-length.

15. Multiplet Separations in the Complex Spectra of Diatomic Molucules.

V. RAMAKRISHNA RAO, Waltair.

In the analysis of the complex spectra of diatomic molecules like the Hydrides and Halides of Manganese, Chromium and Titanium etc., it is observed that an idea of the order of Multiplet separations is more important than that of the vibrational intervals. Attempts are made to arrive at the probable order of magnitude of the Multiplet separations by comparing the A factor in the molecule MX with the A factor for:

1. the corresponding atomic terms in the element M,
2. the corresponding atomic terms in the singly ionised element M^+,
3. the corresponding atomic terms in the neutral element isoelectronic with M^+,

A comparative study showed that the data from methods 1 and 2 are more reliable and may be taken recourse to in arriving at the probable order of multiplet separations.

16. Intensity of Fluorescence in relation to Polarisation and Lifetime.

N. R. TAWDE *and* N. RAMANATHAN, Bombay.

The intensity, polarisation and lifetime of excited states of molecules are closely related. On considerations of the probabilities of deactivation of excited molecules by emission of light or by other modes, it is concluded from observations on dyestuff solutions that while viscosity and temperature do nota ffect the intensity of the fluorescent light at the ranges employed in the investigation, concentration of the dyestuff influences the intensity to a great extent. A critical concentration of the fluorescent substance exists in the case of every fluorescent solution, above which all the three factors of intensity, polarisation and lifetime decrease with concentration and below which the latter two remain constant while the intensity decrease in concentration. That all the three tend to zero value is shown by the fact that dyestuffs do not fluoresce when they are not in solution.

3. Meteorology Geophysice, Oceanography.

17. The Diurnal and seasonal Variations of the 'Surface' Wind at Vizagapatam.

K. S. AGARWALA, New Delhi.

In continuation of the author's previous work (Proc. 36th Indian Sci. Cong. Allahabad, 1949. Part III, Phys. Sec.) the present paper discusses the diurnal and seasonal variations of the wind at Vizagapatam at a height of 56½ feet above ground. Curves showing the mean diurnal variation of the wind speed for the twelve months of the year are given and discussed; these curves generally show two maxima—a strong one in the early afternoon and a feeble one at night or in the early morning hours. A rough estimate of the value of the coefficient of eddy diffusion works out to be 137 in C.G.S. units. Tables of frequencies of prevailing wind direction at 3-hourly intervals for each month of the year are given and their interesting features are described; a table showing the diurnal variation of 'calms' is also included. The general characteristics of land and sea breezes occurring at the station are briefly mentioned. The annual variation of the velocity and direction of wind as well as its steadiness is also briefly discussed. The mean monthly steaidness is found to vary from 60% to 92%.

18. Fluctuations of Annual Rainfall in Central India, 1872-1947.

K. S. AGARWALA, New Delhi.

In a paper (India Met. Dept. Memoirs Vol. XXI, Part I) on the meteorological evidence for supposed changes of climate in India, published in 1910, Sir Gilbert Walker had come to the conclusion that although there was no proof of any permanent climatic change, there had been a tendency over Northwest and Central India for the rainfall to fluctuate considerably. The present paper examines the question further for Central India and presents the results of study of the annual rainfall data for Central India for the seventysix years 1872-1947. Tables and graphs showing the year to year variations, 10 -year means and means for longer periods are given to indicate the general trend of the fluctuations in the annual rainfall and their chief features are discussed. The two driest years were 1899 and 1918 with annual rainfall 23".45 and 23".08 respectively and the wettest year was 1934 with annual rainfall of 58".74 while the average for the period 1872-1947 is 40".92. The data do not suggest any permanent climatic change in Central India. There are, however, indications of a wet period alternating with a dry one. The rainfall deficiencies from 1895 to 1921 point to a dry period. A wet period set in from 1922 and there has been a tendency for an increase in the annual rainfall since then. If the indication of alternative wet and dry periods remains significant, it is possible that a downward trend may begin in the years ahead.

19. The Lunar Atmospheric Tide at Trivandrum and Augustia.

S. K. **Pramanik**, Poona.

Chapman and co-workers have given determinations of the atmospheric lunar tide at a large number of stations and the author and co-workers for 3 stations in India. The present paper gives the lunar atmospheric tide at Trivandrum and Augustia.

The data of Trivandrum consisted of hourly eye observations of barometer except on Sundays for the periods 1853-55 and 1856-64, and for Augustia consisted of similar observations for the periods January 1856 to September 1858 and June to December 1864. The data were analysed by the Chapman-Miller method.

The mean annual tide only was determined for Augustia and for Trivandrum for the years 1853-56 as the periods were short, but for Trivandrum for the years 1856-1864 the seasonal values of the tide were also determined.

The values of the semidiurnal component (C_2) and the phase (θ_2) of the lunar tide with the probable error (P.E.) and the number of days (N) are given below.

Station	N	C_2	θ_2	P.E.
Trivandrum (1853-55)	938	40.0	70.2°	±6.5
Trivandrum (1856-64)	2815	54.2	74.1°	±6.1
Trivandrum (1953-55 & (1856-64)	3753	50.7	73.1°	±6.2
Augustia	914	49.3	75.2°	±7.2

As found previously of two places close by at considerably different hights the amplitude at the higher place Augustia is also less and the phase greater than at Trivandrum.

The seasonal values of the second component of the lunar tide at Trivandrum are given below.

Season	N	C_2	θ_2	P.E.
J	947	61.0	104.5°	± 9.6
E	943	53.4	71.7°	±10.5
D	925	63.8	47.2°	±11.9

20. Performance Characteristics of the Fan-type Radiosonde.

V. **Kalyanasundaram**, New Delhi.

The paper presents the results of a number of soundings made at Poona with two F-type radiosondes attached to the same baloon. The differences between the dry bulb and wet bulb temperatures recorded by the two instruments at the standard pressure levels have been worked out. The performance of the aneroid and the dry and wet bimetals of the two instruments has been independently studed and from more than a hundred "comparative ascents" it has been found that any two aneroids generally record a difference of 3 to 6 millibars and any two bimetals record a difference less than 1°C. The agreement between the pressure and temperature measurements of the two instruments without and after applying the zero shift correction is also examined. The paper also presents the results of a few experiments made in the laboratory on the temperature effect and the hysteresis lag on the radiosonde aneroids.

21. A Study of the Speed Rotation of the Fan of the F-type Radio-meteorograph during Ascent.

A. P. **Jayarajan**

The variation of the rate of rotation of the fan operating the F-type radio-meteorograph over Poona with height was analysed. From the preliminary examination made, it appears to decrease with height up to the 600 mb. level above which it remains almost steady up to about the 400 mb. level above which, the rate increases during winter and decreases during the monsoon. An examination of the rate of rotation of the fan and the wind speed at various levels showed that generally there was increase in speed of rotation when the wind speed increased. Whether the increase in the rate of rotation is associated with regions of increased rate of ascent of the balloon in these regions is under examination.

22. Response characteristics of Electromagnetic seismographs to an impressed Impulse and their dependence on the Instrumental Constants.

S. K. Chakrabarty, Calcutta.

The works of Jeffreys and others have shown that the nature of disturbances produced by the arrival of P and S waves associated with an earthquake is more to an impulsive motion than to a simple harmonic motion. The response of an electromagnetic seismograph of the most general type, when the seismometer frame is subjected to an impulsive force has been worked out theoretically and the variation of the response with the change of the instrumental constants have been analysed. The results thus obtained have been discussed in relation to the interpretation of the data pertaining to the seismological methods of prospecting for oils and minerals and those relating to earthquake seismology which are used for the geological study of the internal constitution of the earth.

23. On Blackett's Fundamental Theory of Magnetism by Rotation.

K. S. Raja Rao.

Blackett's formula $P = \frac{G^{\frac{1}{2}}}{c} U$ is examined vectorially and found to be unbalanced.

It is found that on account of the obliquity of the axes of magnetisation and of rotation, the law is unable to explain the asymmetry of the earth's magnetic field. The phenomenon of secular variation cannot be explained by the fundamental theory of magnetism by rotation. In the case of the sun, the series of experiments show that the general megnetic field is not constant, but varying and hence the fundamental law cannot be applied. Chapman has shown that the large magnetic fields of the sunspots also cannot be explained, according to Blackett's theory. Hence the law cannot be claimed as a general law of nature.

24. The Geomagnetic Equator.

K. S. Raja Rao.

The essential distinction between magnetic and geomagnetic latitudes is brought out. The polarisation of radio waves at Huancayo show that the geomagnetic latitudes are controlled by the ionosphere. Appleton's plot of F2 critical frequencies against geomagnetic latitudes shows that the latter have to be used for ionospheric work. The apparent divergence between the magnetic and geomagnetic latitudes is explained. The idea of eccentric dipole, as opposed to centric dipole, is brought out. The assymmetry in the earth's field is able to explain the cosmic ray observation of clay and others. A map of Southern India showing magnetic and geomagnetic latitudes has been drawn. It is suggested that for all physical problems connected with cosmic rays and ionosphere, the geomagnetic latitudes have to be used.

4. Light

25. Polarisation of Light Scattered by liquid Droplets.

M. M. Paranjpe *and* M. V. Shingre, Bombay.

The polarisation of light scatterd by liquid droplets was computed on Mie's electromagnetic theory of scattered light. An experimental verification of the computed results was also carried out for certain values of scattering angles. It is found that the polari-

sation obtained experimentally agrees with the theoretical values in sign only but not in magnitude.

26. The First minimum in the Intensity of Light Scattered by small Liquid drops and the drop-size.

M. M. PARANJPE *and* M, V. SHINGRE, Bombay

On the electromagnetic theory of scattering of light developed by G. Mie calculations of intensities of scattered light are worked out for a definite size of the scattering particle of liquids of refractive indices varying from 1.33 to 1.63. These calculations reveal the presence of a sharp minimum in the intensity of the scattered light in the vicinity of the transmitted beam. The angle of scattering at which this minimum occurs almost coincides with the angular radius of the dark corona ring of the first order formed by diffraction of light through the cloud of liquid drops. Hence the first minimum in the scattered intensity may be used as a measure of the drop size if the scattering angle at which this minimum occurs is experimentally determined by measuring intensities of scattered light in the forward direction.

27. Studies in Colloid Optics.

P. K. KATTI, Poona.

Change of size and shape of colloidal starch particles in a soluble starch sol at different temperatures has been studied by the light-scattering technique of R.S. Krishnan by using a pair of double image prisms.

Changes in intensity of the transversly scattered light have been measured by an electronic photometer.

The following results have been obtained.

The starch sol contains particles of very small size ($r << \lambda$) at 100°C.

Intensity and depolarisation values remain constant up to 35°C if the sol is slowly cooled below 100°C.

Below 35°C the intensity and depolarisation measurements show the gradual increase in the size and anisotropy of the particles till a constant maximum value of the size is reached in a weeks time. The final maxmum size increases with decrease in the temperature up to 20°C.

However on reheating a turbid sol it was found that the orginal intensity and deploarisation values are not retraced. Instead they persist upto 65°C above which they rapidly fall off to the original sol values.

5. Electronics

28. A New Method of Determining Thermionic Constants.

S. B. L. MATHUR, Lucknow.

A new method of determining Thermionic Constants has been developed under the guidance of Sir K. S. Krishnan in the Physics Laboratory of the University of Allahabad. The metal under investigation is taken in the form of a hollow cylinder closed on all sides except for a small hole at one end. When such a cylinder is heated to different temperatures in vacuum by being enclosed in a graphite furnace tube fed with heavy electric currents from a transformer the electrons emitted by the inner surface of the cylinder soon acquire an electronic gas pressure in equillibrium with the emitting surface. On account of this pressure the electrons effuse out through the hole and those lying within the cone formed with the hole as apex and the diameter of the diaphragm of a Faraday Cylinder kept a few mms. in front of the hole as base are collected by the Faraday Cylinder. From the effusion current at different temperatures the thermionic constants are calculated. This method has some distinct advantages over the usual Richardson type of experimental investigations.

29. Intensity of Electrical pulses of highly damped sinuous type in high frequency channels:

S. R. KHASTGIR *and* ASIT SEN, Banaras & Calcutta.

The effect of a highly damped sinusoidal electrical impulse on the receiving circuit consisting of inductance, capacity and resistance was examined theoretically by E. B. Mou llin and L. B. Turner. The analysis showed that the voltage developed across the inductance consisted primarily of a high frequency term corresponding to the natural frequency of the circuit, the low frequency term involving the *quasi*-frequency of the impulse being negligibly small. Considering only the high frequency term, the voltage across the inductance was shown to be inversely proportional to the frequency to which the receiving circuit was tuned. The Fourier analysis by Burch & Bloemsma of a highly damped sinuous pulse, on the other hand, showed that for frequencies much greater than the *quasi*-frequency of the pulse, the amplitude of the particular Fourier component would be inversely proportional to the square of the frequency to which the receiver would be tuned.

To test the validity of the theoretical deductions, experiments were carried out with a H/F amplifier unit which could be tuned to different frequencies within a limited range (170-204 Kc./S) and a Cathode ray oscillograph. The experiments, the details of which are given in the paper, showed that when there was a damped sinuous discharge through an L-C-R circuit, the variation of the H/F voltage developed across the inductance of the circuit with the frequency channel followed the inverse-frequency law rather than the inverse-square law.

30. Periodic Fading or Short-wave Radio Signals

S. R. KHASTGIR *and* P. M. DAS, Benares.

Periodic fading patterns were recorded photographically with Calcutta signals of 4840 Kc/S received at Dacca (distance 240 Km.) during the evening and early night hours of last winter. The main features in the experimental conditions were :—(i) The operating frequency was very much less than the M.U.F. for the F-layer transmission, (ii) the frequency was slightly greater than the M.UF. for the ordinary wave transmission through the E-layer and (iii) it was slightly less than the M.U.F. for the extraordinary wave transmission through the E-layer between the transmitting and receiving stations. The following patterns of priodic or rhythmic fading were observed :

(1) *Sinuous fading of comparatively quick period* : This is considered to be of magneto-ionic origin as being due to the interference between the upper and lower trajectory *extra-ordinary* waves in the E-layer, the ordinary waves having passed through the E-layer.

(2) *Periodic or rhythmic fading of comparatively slow period* : According a new theory that has been proposed, the slow periodic fading was caused by the beat-effect between the singly and doubly reflected waves from the F_2-region or between the singly reflected waves from the E-and F_2-regions, the two interfering waves in different directions having suffered different amountsofDöppler change of frequency due to the vertical movement of the ionospheric layer or layers.

The values of the vertical velocity of the ionosphere as obtained from the proposed theory agreed with the observed values.

(3) *Slow periodic fading with superposed ripples* : This was observed when the ionospheric conditions were favorable for the simultaneous occurrence of the magneto-ionic type of sinuous fading and the Doppler-beat type of slow periodic fading.

The investigation showed that quick random fading was only occasionally observed with 4840 Kc/S signals. The intensity distribution in quick random fading was found to be different from the Rayleigh distribution. There was also evidence of extremely high frequencies (4-12 cycles/sec.) in a few patterns of periodic fading, the origin of which is unknown.

31. The instalation and operation of 10 Cm Radar.

JUGAL KISHORE, Delhi.

A 10 cm Radar set with peak power of 350 K.W. has been set into operation. Several interesting features of the equipment are discussed. The initial difficulties in its operation and the manner of overcoming them are also described.

32. Reflection from Tropospheric layers at 10 Cm.

JUGAL KISHORE, Delhi.

Preliminary results on the sounding of the troposphere to investigate the existence of reflecting layers are presented. By using a high energy pulse (350 K.W.) at 3000 Mc/s, radiated vertically upwards, it has been found possible to record echoes from layers at heights of the order of 1000 to 6000 feet. The possible explanation of this phenomenon are discussed.

6. Ionics

33. Mean Energy of Electrons in H.F. Discharge in H_2

N. R. TAWDE *and* G. K. METHA, Bombay.

The mean energy of electrons in the glow column of h.f. discharge in hydrogen has been measured;by two-independent methods under precisely known conditions. Brasefield's method of estimating the energy by ratio of the intensities of two neighbouring lines in the secondary spectrum of hydrogen, gives values in the neighbourhood of 25 eV. These are much higher as compared to 8 eV. found from probe measurements. Brasefield's general conclusion about the variation of mean energy caused by changing the discharge parameter seem to be true for certain range of pressure and voltage only. The probable sources of error in estimating the mean energy by two methods considered along with the general mechanism of the discharge supports the lower values found by probe measurements.

34. Production of Joshi-Effect in Arsenic Vapour.

P. DAS GUPTA, Banaras.

The above phenomenon has been observed for the first time in arsenic vapour. A siemens' type ozoniser is given a fine coating of arsenic and then evacuated by means of a topler pump. The possibility of the presence of Hg vapour in the ozoniser is removed by inserting a liquid air trap between the ozoniser and the pump. It isfound that no appreciable period of 'ageing' is necessary for the production of the effect. At the threshold potential V_m, the *Joshi-Effect* is about 40% which decreases sharply on increasing the applied potential. The effect decreases in the following order, blue> green>red. An appreciable decrease in *Joshi-Effect* is observed as the supply frequency is increased in the order 50,100 and 500 cycles per second.

35. Spectroscopic study of *Joshi-Effect* in Sulphur vapour.

P. DAS GUPTA, Banaras.

A spectroscopic study of the phenomenon in sulphur vapour was undertaken to determine if the magnitude of the *Joshi-Effect* was independent of selective light absorption. Sulphur vapour in a modified from of siemens' tube was excited by A.C. supply of frequencies 50 and 500 cycles per second. A double diode 80 was used for current detection. A 200 Watt bulb, mercury vapour lamp and hydrogen discharge lamp were used to irradiate the discharge tube longitudnally. At optimum conditions near V_m the relative *Joshi-Effect* observed was 65%, 70% and 15% respectively.

The absorption spectrum of the sulphur vapour in the normal and in excited states was then studied witha quartz spectroscope using electric bulb, mercury arc lamp and hydrogen discharge lamp as sources of light. No difference could be found in the absorption spectrum of excited and unexcited gas in all the three cases.

36. Production of *Joshi-Effect* under X-rays in Arsenic vapour.

P. DAS GUPTA, Banaras

Production of *Joshi-Effect* using X-rays as the source of irradiation has been reported earlier. In the present case use of X-rays as a source of irradiation for production of the *Joshi-Effect* in arsenic vapour reveals interesting results. Thus it is found that when the tube is irradiated with soft rays (55 kV) positive *Joshi-Effect* is obsrved at all the potentials. On using hard rays (65 kV) as the source of irradiation negative *Joshi-Effect* is observed at the same potentials.

37. *Joshi-Effect* in Sulphur vapour in L.F. and H.F. components of the total discharge current.

P. DAS GUPTA, Banaras.

The present work is a continuation of the work previously reported on the *Joshi-Effect* in sluphur vapour where the influence of different factors *viz.*, temperature, X-rays, light frequencies in the total L.T. current had been investigated. The results now being reported refer to the influence of different factors on the L.F. and H.F. components of the discharge current in sulphur vapour. (i) An iron core inductance which preferentially admits L.F. component ($i_{L.F.}$) in $i_{L.T.}$ and inhibits $i_{H.F.}$, the latter being by-passed to earth by using a condenser which comparativey impedes L.F., and (ii) a condenser connected in series with the L.T. whch admits the H.F blocking the L.F. component, are used for the expermients. The magnitude of *Joshi-Effect* in different components varies in the following order H.F. > L.T. > L.F. This result is in accord with previous findings.

38. Studies of the Joshi Effect in chlorine under ozonizer excitation—Influence of temperature.

K. S. VISVANATHAN, Benares.

The influence of temperature, varied in the range 8-67°C, on the magnitude of of the *Joshi-Effect* in Cl_2 taken in the pressure range 55.5 - 390 mm and excited in a Siemens' ozonizer due to potentials (6.68—13.35 kV) of 50 cycles frequency has been studied. The magnitude of both the net as well as the relative *Effect* decreases with increase of temperature; the influence of the applied potential is to increase the net *Effect* and decrease the relative *Effect*. The inhibitive influence of temperature is more pronounced at lower than at higher applied potentials.

39. Production of *Irreversible Joshi-Effect in* (N_2+3H_2) mixtures

K. S. VISVANATHAN, S. V. MUTHUSWAMI *and* R. KRISHNAMURTHY,
Benares

Results for the potential variation of the *Joshi-Effect* in ($N_2 + 3H_2$) mixtures obtained as the final decomposition products of NH_3 in the silent electric discharge show that the *Effect* is of a much larger magnitude and is obtained over a longer range of pressures (30-420 mm) than in pure NH_3. The *Effect*, maximum at V_m, falls off rapidly, almost precipitously, with increase of applied potential. The *Effect* is maximum (80%) at 272.5 mm of the mixture.

An apparently anomalous *Joshi-Effect* was observed in the system at high pressures *viz.*, 230-420 mm. At these pressures, the system which gave the normal *Joshi-Effect* behaved abnormally when the applied potential reached a certain value; the conductivity of the system, though it decreased on irradiation, did not regain its original value on shutting off the incident light. This *irreversible Joshi-Effect* persists over a potential range which is the larger the higher the pressure of the gas. At potentials above the upper limit, the system once again regains its capacity to show the familiar reversible *Joshi-Effect*. The range of applied potentials in which the irreversible Effect is observed is extended by lowering the temperature of the system; above 30°C this phenomenon is not observed.

40. Investigation of *Joshi-Effect* in Chlorine from the standpoint of heat dissipation in the system.

K. S. VISVANATHAN, S. V. MUTHUSWAMY *and* R. KRISHNAMURTHY,
Benares.

Arising out of Prof. Joshi's preliminary observations, production of the *Joshi-Effect* in Chlorine has been investigated from a new standpoint viz., the rate of heat dissipation in the system when the ozonizer is (a) in the dark and (b) under irradiation.

Chlorine at a pressure appropriate to giving about 40% *Joshi-Effect* was excited in a sealed Siemen's Ozoniser at 6.41, 6.68 and 6.95 *k*V of 50 cycles frequency. The rate of rise of temperature of the system was measured by means of a sensitive alcohol thermometer enclosed in the annular space of the ozonizer. It is found that the rate of heat dissipation in the system is appreciably greater in dark than under light when the conductivity of the system is lower. This indicates that the chief seat of the *Joshi-Effect* may be considered to be in the ohmic part of the conductivity as distinct from the displacement components thereof.

41. Potential-Variation of the Ozoniser-Impedance in the Production of Joshi-Effect.

B. N. PRASAD *and* B. B. PRASAD, Benaras.

Production of *Joshi-Effect* Δi under ozoniser discharge was studied in gases and vapours at various applied potentials V of 50 cycles frequency. By the values of current in dark i_D and under light i_L, the impedance of the ozoniser circuit in dark $Z_D = \frac{V}{i_D}$ and under light $Z_L = \frac{V}{i_L}$ were calculated at various V. A scrutiny of these results along with 200 published and much larger unpublished results in excited chlorine, bromine, iodine, oxygen and mercury vapour *etc.*, over a wide range of exciting conditions, reveals that the influence of an increase in V is always to decrease Z_L. The quantity Z_D, however, in certain cases shows an increase and in others a decrease, which, in part, has been attributed to the comparative decreases of the gas capacity C_g and the resistance R_g (the nverse of conduction current) which is in parallel to C_g, depending upon the gas pressure. Taking into consideration the equation

$$i = \frac{V}{jL\Sigma f + \frac{1}{jC_w\Sigma f} + \frac{1}{jC_g\Sigma f + \frac{1}{R_g}}}$$

for this ozoniser current (Joshi, *Curr. Sci.*, 1947, *16*, 19-21), it has been shown that an increase in Z_D with V is associated with an increase in Σf, the total number of frequencies generated in the discharge space. Further-more, assuming the influence of light, if any, to be constant on R_g, C_g, C_w, and Σf, it has been shown that the decrease of Z_L with an increase in V can result only from an increase in R_g under light.

42. Influence of Space-Charge on *Joshi-Effect.*

D. P. JATAR, Sangar.

Joshi's Theory (*Curr. Sci.*, 1945, *14*, 175, and *ibid*, 1947, *16*, 19). of the above phenomenon postulates: (*a*) photo-electric emission from a boundary layer (*b*) characterised by a low work function, as the first stage leading to *positive Joshi-Effect* ($+\Delta i$), if free from secondary changes, (*c*) the *negative Joshi-Effect* is attributed to negative ion formation due to capture by excited particles of electrons from (*a*). If it be assumed (*d*) that the density of the positive space-charge increases with the applied V; and that it favours $+\Delta i$, and (*e*) the work function is affected by the magnitude and *sense* of the surface field intensity, a consistant explanation is obtained for the results of an exhaustive investigation on the production of $\mp\Delta i$ in chlorine under sleeve excitation by (1) A.C. and (2) D.C. potentials; in the presence of an axial wire which was (3) floating, (4) earthed directly, R = 0, (5) earthed through R varied from 0.25 to 1.0 M Ω, and (6) when R was capacitatively bypassed over the range 0.02 to 0.0002 μf. Results under (1) and (2) were varied by terminal reversal, leading to a large relative increase of the H.T. electrode surface.

43. Production of the *Joshi-Effect* in the Infra-red

S. R. MOHANTY *and* SATYA PRAKASH, Benares.

The present work was carried out in order to investigate by direct observation the producibility of the *Joshi-effect* in oxygen when exposed to the infra-red. A (glass) Siemen's tube containing purified oxygen at 308 mm. Hg. was excited at different potentials V, over 2.26 to 4.26*k*V (r.m.s.) of 50 cycles frequency. A *Joshi-effect* Δi of 63% was observed near the 'threshold potential' V_m with *unfiltered* carbon-arc radiations. When these radiations were filtered through 1 cm. thickness of a 7.5% solution of iodine in carbon disulphide, Δi of 0.6 to 1.4% was observed at $V > V_m$, and is ascribed tentatively to the influence of the near infra-red. With the above filter, light from mid-day sun during summer, as also that from an intense carbon-arc was not perceptible to the eye. At constant V, the discharge current i flowing through the system exposed simultaneously to the infra-red increased with time. Thermometric studies revealed that the above filter out off a part of the heat radiations as well from the arc The filtered heat radiations affected panchromatic films. Head radiations from a 1000 Watt incandescent bulb, the filter being a heavily smoked glass plate, showed no Δi.

44. On the Positive-Negative Inversion of the Joshi Effect with the Intensity of Irradiation.

H. J. ARNIKAR, Banaras.

The earlier finding of Joshi that the inversion potential for the reversible transition of the positive and negative Joshi effects in potassium vapour is sensitive to changes in the intensity of irradiation, has been extended to other systems, *e.g.*, Cl_2, Se-Se vapour, air and H_2. Under costant potential, the transition $+\Delta i \rightleftarrows -\Delta i$ in these systems has been found to be sharply intensity reversible. For instance, in the system Cl_2 contained in a silver-wire-in glass cylinder under a pressure of 170 mm Hg, and excited at a potential of 4.21 *k*V (50 c.p.s.), a change in intensity from 446 to 452 (arbitrary units), *reversibly* changes the Δi from + 10 to − 20. Similarly in the system Se-Se vapour at a potential of 0.9 *k*V (50 c.p.s.) a change in intensity from 40 to 96 changes the relative Joshi effect reversibly from + 5 to − 8%. Besides these, similar intensity inversions have been observed in air and H_2 for light from both an incandescent bulb and an H*g* lamp by the author, and in the systems N_2 and H_2O vapour by others in these laboratories.

45. Joshi Effect in Solid-Vapour Systems: Part II Te-Te Vapour

H. J. ARNIKAR, Banaras.

A tellurium coated all glass ozonizer free from Hg vapour was prepared for selenium and it was found possible to induce the Joshi effect in the tube with but a few minutes' aging under discharge. Unlike Se, the Te tube showed only the negative Joshi effect over the entire potential range tried both of 50 and 500 c.p.s. frequency, and both for light from a 200-watt bulb and from a quartz Hg lamp. In fields of 50 c.p.s. frequency and under light from the former source, the relative Joshi effect rises from—50% at 0.80 *k*V to a maximum of—75% at 0.88 *k*v and thereafter diminishes to 18% at 2.00 *k*V. Under light from a quartz-Hg lamp, slightly lower values of the Joshi effect were recorded, the values being −33, −68, and −19% for the potentials cited above, although the maximum value is spread over a longer potential range (0.88 to 1.50 *k*V). In fields of 500 c.p.s. frequency, although the current was some 20-50 times more, the maximum Joshi effect recorded under light from the 200-watt bulb was only −7% occuring at 1.08 *k*V, which diminished rapidly to about −1% at 1.75 *k*V. Unlike in fields of the lower supply frequency, considerably higher values of $\%\Delta i$ were recorded under irradiation by Hg vapour light, the values being −26% at 1.00 *k*V. and—7% at 1.40 *k*V.

46. Joshi-Effect in Solid-Vapour System: Part III Zn-Zn Vapour

H. J. ARNIKAR, Banaras.

A zinc coated all glass oznizer free from Hg vapour was prepared by the same technque as was used forSe and Te (*Proc. Ind. Sci. Cong.*, 1949 Phys. Sect. Abs. No. 14) and values of the Joshi effect in the system Zn-Zn vapour were recorded for potentials in the range 0.7 to 2.0 *k*V. of both 50 and 500 c.p.s. supply frequency and for irradiation by light from both a 200-watt bub and a quartz—Hg lamp As in the case of the Se, and Te systems the $\%\Delta i$ is numerically greater under fields of 50 than under 500 c.p.s being −67 and −16% respectively at the optimum potentials, and for visible light. The corresponding values under light from a quartz-Hg lamp are −70 and −32% showing tha the increase in $-\%\Delta$ due to this source of light is appreciable only in the case of excitation by fields of 500 c p.s. frequency, which behaviour is reminiscent of that of Te and Se. No positive effect was observed under the conditions examined, thus resembling Te and differing from Se. The Zn-tube also differed from both the Se-and Te-tubes in that no fatigue effects were detected in it even after prolonged excitation.

47. Threshold Frequency for the Production of the Negative Joshi Effect Selenium-Selenium Vapour.

H. J. ARNIKAR, Banaras.

By the technique earlier reported *Proc Ind. Sci Cong.*, 1949 Phys Sect Abs No. 14), values for the Joshi effect were recorded for the system Se-Se vapour produced free from Hg vapour for irradiation by visible light of a 200-watt, 210-volt bulb, monochromatized by Wratten filters Nos. 70-76. Additional values were obtained using a sodium and a mercury lamp together with Wratten filters Nos. 50 and 62. Thus, in all 9 nearly monochromatic sources were used, their transmission peaks being at 4358, 4400, 4900, 5300, 5460, 5700, 5800 6100, and 7000 A. units. The total intensities of the filtered radiation, measured both by a thermopile (Kipps 37) and by a Se photo cell (Megatron), were found to be within the saturation limits for the production of the Joshi effect. The isopotentials for the $-\%\Delta i$ versus the peak transmission wavelength when extrapolated to the zero value were found to meet the wavelength axis in the region 8000-8500A. From this the mean value of 8250A appears to be the threshold wavelength of irradation in the production of the *negative* Joshi effect in the system Se-Se vapour.

48. On the Time Disparity in the Production of the Joshi Effect in Different systems

H. J. ARNIKAR, Banaras.

A persistently one sided disparity in the times for the establishment and the subsequent annulment in *full* of the Joshi effect, which is independent of the detector characteristics has already been reported for the systems Hg vapour and halogens (Arnikar, *Proc. Ind. Sci. Cong.*, Phys. Sect, Abs. No. 16). A similar disparity has been observed in numerous other systems including H_2, Se-Se vapour, and in H_2O and D_2O vapours, the last for irradiation by both visible and ultra-violet light, the heavy water vapour being contained in a quartz ozonizer. As in the systems previously reported, the disparity expressed as a ratio of the time of full recovery of the current on cutting off the light, to the time of suppression in full of the current under light, has been found to vary in the same manner as the $\%\ \Delta i$ for changes in the different determinants as, the potential and frequency of the applied field, the intensity and frequency of irradiation; the temperature and pressure of the system; and the proportion of the H.F. and L.F. components in the discharge current.

An explanation of the time disparity seems to be possible on the view suggested earlier by the author (*Proc. Ind. Sci. Cong.*, 1949, Phys. Sect., Abs. No. 12), that the process of formation of the space charge sheaths responsible for the Joshi effect is almost instantaneous, whereas their subsequent destruction is a slower process, being dependent on the kinetic-molecular and -ionic agitations against them. The observed decrease in the time disparity with an increase of temperature, pressure, potential, and frequency of the discharge are consistent with this view of the origin of the Joshi effect.

49. Inversion of *Joshi-Effect* in Iodine Vapour

M. V. RAMANAMURTI, Banaras

Exhaustive studies both in full—and semi-ozoniser type discharges on *Joshi-effect*, Δi in iodine vapour have shown that the *inversion* can also be affected at constant V and *t* with a variation of the corresponding light intensity I or light frequency ν. Positive *Joshi-effect* $+\Delta i$, near V_c, increases rapidly with I to a maximum value with a slow decrease threafter, finally passing over into $-\Delta i$. Thus *e.g.* at 300 V (20°C), $\%\Delta i$ was $+148(I=5)$, $+272$ $(I=80)$, $+42$ $(I=1000)$ and -17 $(I=1700)$; with the *inversion* at $I=4500$, which corresponds, therefore to the *critical inversion intensity* values I_c. At potentials slightly above V_m, the *effect* Δi. was negative under blue ; passed over, under green, to $+\Delta i$ which increased further under red, the corresponding light intensity being constant. Thus *e.g.*, at 306 V (20°C), $\%\Delta i$ was -23 blue, $+6.5$ (green) and $+29$ (red). This was shown to be repeatedly reversible, and hence the *inversion* to occur at a frequency (ν_c) above the green which is, therefore, the *critical inversion frequency*. Existence of V_c, T_c, I_c, and ν_c simply indicates Joshi's generalisation of a simultaneous occurrence of both $+$ and Δi, the greater in magnitude depending upon the operative conditions, determining the sign of the net *effect* Δi.

50. Production of *Joshi-Effect* in Nitrogen

M. V. Ramanamurti, Banaras.

From very limited studies at gas pressures 'P' 26 and 45 *mm* Hg, the occurrence, (upto a maximum of 3%) *Joshi-effect* in nitrogen was reported. Exhaustive investigations in nitrogen, now made, showed that under optimum conditions, *viz.*, $P_{N_2} = 19$ *mm* Hg at 20°C, at V_m, the *effect* is nearly 96% photo-diminution of i. Nitrogen gas pressures > 25 and < 5 *mm* Hg (20°C) are found to be unfavourable for Δi and this probably is responsible for the low value of Δi already reported. Increased temperature t, applied potential V and the supply frequency, decrease the *effect* $-\Delta i$ in nitrogen; while ght intensity I and light frequency, increase it. A rise in t, deconditions and depolarises the activated boundary layer responsible for $-\Delta i$; hence the decrease with t of the latter follows. The *effect* is maximum near V_m, and decrease thereafter. Thus *e.g.*, at $P_{N_2} = 22$ *mm* Hg (20°C), $\%\Delta i$ 58 at 1.6 kV ($= V_m$) is decreased to 12 at 4.05 kV.

51. Comparative Production of *Joshi-Effect* in Ordinary and Heavy Water Vapour

N. Atchuta Ramaiah, Benares.

Potential variation of the *effect* Δi at different H_2O vapour pressures p varied in the range 3-32 mm. Hg was studied in a Siemen's type silica ozoniser. Experiments were repeated with D_2O vapour contained in the same ozoniser (after complete removal of H_2O vapour). It was interesting to note that as observed in H_2O vapour, an appreciable *Joshi effect* $\pm\Delta i$ was detected in D_2O vapour. The influence on Δi of applied *k*V and of vapour pressure p was in agreement with the general finding due to Joshi. Further, there was no marked difference between the data obtained in the two experiments. Thus *e.g.*, at 0.6 *k*V positive *Joshi effect* $+\Delta i$ corresponded to 23% and 20% current increase in H_2O and D_2O vapours ($p = 15$ mm. Hg) respectively; the negative *effect* $-\%\Delta i$ at 0.88 *k*V was 32.3 and 32.6. By a pressure rise of 17 mm., the values of $-\%\Delta i$ decreased to 13.5 and 14.1. The like behaviour of Δi observed in H_2O and D_2O vapours in respect of potential variation throughout the pressure range investigated and especially of having the same optimum pressure *viz.*, 15 mm. Hg, might be due to the identical extra-nuclear-electronic configuration of H_2O and D_2O.

52. Influence of a series and parallel connected ozonizer on the production of *Joshi-Effect*.

B. R. Marathe, Banaras.

The experiments carried out with a spark gap in the circuit were extended by replacing the spark gap by an ozonizer. When two ozonizers of different sizes and containing different gases were connected in parallel, their respective values of V_m were the same as those when excited seperately. *Joshi-Effect* was sensibly smaller on irradiating either of the ozonizers than when both were irradiated. As observed from the wave form on the Cathode Ray oscilloscope, there were two groups of H.F.s intermixed characteristic of the respective currents in the two ozonizers. Irradiation of one of them reduced the amplitudes of one group of H.F.s while H.F.s in both the groups were reduced in amplitude when both the ozonizers were exposed to light.

53. Influence of a serial spark on the production of Joshi effect.

B. R. Marathe, Banaras.

Joshi-Effect markedly depends upon the value of the applied potential and its frequency. When the spark gap was included between the H.T. terminal of the transformer and the ozoniser it was observed that the spark started first and the ozoniser discharge at a higher voltage. V_m, the threshold potential of the ozonizer was increased with the spark in series. Depending upon the spark width the voltage drop across the spark gap varied and this changed V_m which was never less than the sparking voltage. Within the range of the sparking voltage and V_m there was no effect of light on the current. At V_m and higher voltages there was small *positive Joshi-Effect*, upto 10%. At these voltages in the absence of the spark gap as much as 60% *negetive Joshi-Effect* was observed. It is likely that when the spark is introduced in the circuit, the voltage across the ozonizer is insufficient to maintain a steady conductance, the case being similar to the ozonizer below V_m and without a spark gap.

When, however, the spark gap was included between the ozonizer L.T. and the detector, the glow in the ozonizer appeared at V_m with a sudden increase in current. *Negative Joshi-Effect* was observed above V_m upto the sparking voltage and persisted as long as the spark was unsteady. With increase in voltage the spark became steady, the current due to it was large and no effect of light was observed

54. Production of Irreversible positive *Joshi-Effect* in Chlorine below V_m

B. R. MARATHE *and* S. S. BOMMANNAVAR, Banaras.

Over a large range of voltage below V_m the initial current was small and unaffected by light. At voltage V'_r, less than V_m, the threshold potential the current in dark increased on irradiation and was accompanied by short H.F.s at the peaks of the sine wave. On shutting off the light the current increased to a still higher value with larger H.F. amplitudes. This *irreversible positive Joshi-Effect* was observed within a range $V'_1 - V_m$. The increase in current on irradiation depends upon the intensity of light the increase being more with lower intensity.

The current was small and unaffected by light upto V', (1.19 kV). At 1.19kV the current in dark was zero and increased to 2 units on irradiation. On shutting off the light it further increased to 6 units. The voltage was reduced to zero and increased to 1.23V, when the above effect was observed. This is repeatable, *ad libitem* at various voltages upto V_m (1.27kV) when the current increases suddenly even in dark

It is interesting to note that the value of the currnt obtained within the range, $V'_1 - V_m$ on irradiation and then cutting off the light is the same as that obtained by decreasing the voltage below V_m irrespective of the frequency and intensity of the light.

55. Production of irreversible *Joshi-Effect* in Chlorine in the hysterisis range below V

B. R. MARATHE *and* S.S. BOMMANNAVAR, Banares.

With the increase in potential applied to the ozonizer the current was initially of small value i_1 and increased suddenly at V_m, the threshold potential. At this stage the high frequency components were observed with a Cathode Ray Oscilloscope. With a decrese in the potential below V_m the current and H.F.s persisted up to a voltage V_1 due to hysterisis. The *Joshi-Effect* increased gradually below V_m and was almost 100% at and below V_1 and upto V_1. It is in this range. $V_1 - V_1$ that *Joshi-Effect* is irreversible. The current decreased to the value i_1 and H.F.s disappeared on irradiation and both these were not restored to their values in dark after shutting off the light.

The current at V_m (1.40 kV) was 150 units in dark and 55 units in light. On decreasing the voltage upto 1.18 kV, the respective current values in dark and light were 19 and 8 units, the effect being reversible. At V_p (1.16kV) the current in dark was 18 units and reduced to i_1 (5 units) on irradiation which remained of the same value after shutting off the light. The voltage was increased upto V_m and reduced below V_1 when the same irreversible effect was observed upto V_1 (1.12kV).

With higher light intensity the current was reduced to i_1 on irradiation at a higher potential and the *irreversibility range* was thus increased. This range increased with frequency of light and was in the order, unfiltered white > blue > green > red, i.e. frequency-wise.

When the temperature of the ozoniser was increased to 90°C, the current below V_m decreased to i_1 in dark, while there was appreciable current on irradiation. Thus, instead of the irreversible effect, a *positive Joshi-Effect* was observed.

56. Studies of *Joshi-Effect* From the Stand Point of Negative Ion Formation

H. S. NAGARAJAIAH, M. SANYASI RAJU *and* B. B. PRASAD,
Benares.

The production of *Joshi-effect* has been explained on the basis of the formation of negative ions and the corresponding space charge. It was, therefore, of interest to

investigate conditions where probability for the negative ions is comparatively greater. Two ozonisers evacuated except for mercury vapour saturated at the room temparature were taken. They were (i) in which the bulb containing liquid mercury kept away from the annular space was heated to bring about change of pressure, care being taken to screen off heat radiations affecting the ozoniser. (ii) the other in which the entire system was subjected to temperature variations from 0—80°C.

It was found in (i) that the variation of both i_D and Δi at a constant V was very small and presumably within the range of experimental error. In (ii) the *effect* Δi increased initially to a maximum near the room temperature and then decreased with increase of temperature. This when compared to the variation of negative ions with pressure shows a marked similarity which suggests that negative ions and hence space charge presumably be responsible for the decrease of conductivity on irradiation.

57. Development of *Joshi-Effect* in Mercury vapour

H. S. NAGARAJAIAH, M. SANYASI RALU *and* B. B. PRASAD,

Benares.

A detailed investigation shows that long 'ageing' and heat treatment are necessary *only* to extend the effect over a wide range of applied potential. It is now found that about 4 hours of 'ageing' decrease gradually the threshold potential V_m and the conductivity under discharge which are initially high in a Siemen's ozoniser charged with mercury vapour, to a constant minimum, when the effect develops at potentials very near to V_m. The magnitude of Δi is as high as 98%; this decreases very rapidly as the applied voltage is increased slightly and hence the failure of previous workers to detect Δi after comparatively low 'ageing.'

It is seen that the H.F. component though high in the beginning does not have any corresponding Δi but it decreases with 'ageing' to a constant value in about the same period of 4 hours similarly as the total L.T. current and the effect Δi developes. This onset of *Joshi-Effect* only after sufficient 'ageing' and its non-occurence in the beginning even when the H.F. proportion in the discharge current is high suggests that some constant condition such as the formation of a boundary layer as postulated by *Joshi* is necessary for the occurrence of the effect Δi.

58. Production of *Joshi Effect* under X-ray-irradiation in Mercury Vapour.

M. R. BHIDAY, Nagpur.

The observation of Joshi, (current Science, 13. 278, 1944) about the instantaneous, steady and reversible current decrease Δi in an ozoniser containing chlorine, subjected to A.C. discharge and irradiated by X-rays was a very significant result considering the powerful ionising property of x-rays. This investigation is now extended, for the first time, to the mercury vapour.

The experimental set-up is the same as in Joshi's note (loc. cit) except that an R. C.A. 30 triode was used as a diode rectifier in the detector circuit, instead of a vacuo-junction. Radiator type Coolidge tube with W Tungsten target was used as the source of x-rays. (general radiation).

The decrease Δi_x on x-ray irradiation is found to vary smoothly with the hardness and intensity of the rays. Thus e.g. at a potential of 6.8 *k*V applied to the inner electrode of the ozoniser $v\%\Delta i_x$ increased from 2.6 to 25.2 with hardness. Varia-

59. Studies in the change in Silent Electric Discharge-current under an Electrostatic Field. Part I

M. R. BHIDAY, G. V. ASOLKAR *and* V. G. BHIDE, Nagpur

An *analogue* of "Joshi-Effect" under electrostatic Field is now established. This analogous effect now reported is unique and not described, so far known to the authors in the literature of this discharge phenomena.

The diphenyl oxide vapour in an ozonizer is excited in the range 1.6 KV to 6.4 KV, and then subjected to a uniform electrostatic field. An instantaneous, steady and reversible change in the discharge current (Δi_s) is observed. The discharge current passed through a Bell transformer coupled to a diode R.C.A. 30, is measured by a reflection type sensitive Galvanometer.

The $-\%\Delta i_s$ at a certain voltage is found to increase with the E.S. Field—then declines after reaching a peak—ultimately changes sign and becomes $+\%\Delta i_s$. Thus at 2.2 KV the $\%\Delta i_s$ varies from -10.3 reaching a maximum value of -14 then decreases, and finally after reversing the sign gives the value $+13.8$—as the electrostatic field is gradually increased.

60. Studies in the change in silent Electic Discharge current under an Electrostatic Field in Mercury vapour. Part II.

M. R. BHIDAY, V. G. BHIDE *and* G. V. ASOLKAR, Nagpur.

An analogue of Joshi-Effect under electrostatic field is now observed.

The Siemen's type ozoniser filled with pure mercury vapour which was subjected to silent electric discharge was kept in uniform E.S. Field. There was observed an instantaneous, steady and reversible change Δi_s in current.

The percentage of Δi_s was found to depend upon the strength of the Field (E.S.). The decrease in current observed as $-\%\Delta i_s$, at a certain voltage; for lower E.S. field strength, was found to increase with the increase in the E.S. Field—and declined after reaching a peak and ultimately changed sign and became $+\%\Delta i_s$. Thus at 1.6 KV applied potential $-\%\Delta i_s$ changed from -50, reaching a maximum of -59.8 and diminishing to zero—rose further to $+30$.

61. Studies in the change -in Silent Electric Discharge-Current under magnetic Field in Mercury Vapour.

M. R. BHIDAY, V. G. BHIDE *and* G. V. ASOLKAR, Nagpur.

An analogue of 'Joshi Effect' in the magnetic field is described.

The Siemen's type of ozoniser filled with mercury vapour, through which silent electric discharge was passed was placed symmetrically between the poles of an electromagent, giving a uniform field. The discharge current, after rectification through an R.C.A. 30 triode used as a diode, was passed through a sensitive reflection galvanometer—measuring the current by the lamp and scale method.

As soon as the magnetic field was put on, the discharge current changed. This change in the discharge current, called Δi_m was found to be spontaneous, steady and reversible. $-\%\Delta i_m$ was found to decrease with the increase in the magnetic field-strength. Thus at a certain applied potential, a transition from $-\%\Delta i_m$ to $+\%\Delta i_m$ could be observed by increasing the strength of the field. For instance, a representative reading at 1.6 KV, $\%\Delta i_m$ in one direction of the field varied from -58.8 to $+152.5$ while in the other direction, with similar variation of field, $\%\Delta i_m$ changed from -35.3 to $+182.2$. Further significant observation that $\%\Delta i_m$ depended upon the *direction* of the magnetic field has been established.

The *quenching* of the Joshi-Effect, obtained either by white light, or by x-rays, (described by Joshi, current sci. 13, 278, 1944) and further by Bhiday, M.R. and Asolkar, (unpublished data) and by properly adjusting the magnitude and the direction of field has been established.

62. *Joshi-Effect* in Hydrogen

H. J. ARNIKAR *and* V. V. AGASHE, Banaras.

By employing a Siemen's ozonizer of total electrode surface, about 1200 sq. cm. it has been possible to obtain large % Joshi effect, (both + and —) in H_2 under a wide range of pressures. Beginning with high values of several 100% in the pressure range 1—200 mm. Hg, the relative positive Joshi effect diminishes as the potential is increased to the threshold limit whereabout the usual $+\Delta i \rightleftarrows -\Delta i$ transition occurs reversibly. In the last critical stage, however, the $+\Delta i$ (at least partly) occurs irreversibly (i.e. on cutting off the light the photoincrease does not wholly disappear).

The effect of changing the A.C. input frequency $\%\Delta i$ and the effect of increasing the gas pressure were studied. The cathode ray oscillograms revealed that the current structure, which is simple in the dark, develops under irradiation additional lines,

7. General Physics

63. On the Choice of Parameters of Pendant Drop in Surface Tension Measurements:

N. R. TAWDE *and* K. G. PARVATIKAR, Bombay.

By choosing any one or other of the parameters of the pendant drop, calculations of surface tension can be made by the use of established relations. Thus Andreas, Hauser and Tucker have taken the equitorial plane and a selected plane for this purpose. It is also possible to obtain fairly accurate results by obtaining the linear measure of the equitorial plane and the depth of the drop from it and using the tabular functions of Bashforth and Adams and of Fordham. This has been done and results compared with other methods, giving critical discussion as to the experimental errors involved in the adoption of the particular parameters.

64. Performance of Sessile Drop Method in Surface Tension Measurements:

N. R. TAWDE *and* K. G. PARVATIKAR, Bombay.

The case of sessile drop has been considered in relation to the pendant drop. The measureable quantities in the case of sessile drop are *h*, the height above the equatorial plane and *r*, the radius in the equatorial plane. An accurate empirical relation of h/r with a^2 the capillary constant has been drawn up by Taylor and Alexander to bridge the gap between Porter's values and Bashforth and Adam's tables. In this paper use is made directly of B. and A.'s tables to obtain the quantities involved in the derivation of the capillary constant and hence the surface tension. In the light of the results, sources of uncertainties in the tabular quanties and in the experimentally measurable quantities are critically examined.

65. Surface Tension of Milk and its Dilutions.

L. D. MAHAJAN, Patiala.

It has been found that the surface tension of milk varies with the addition of water in it. The greater is the quantity of water mixed with it, the greater becomes its surface tension. The relation is not so simple and rectilinear but is as follows;—

$$T_s = 54 + \left(\frac{m}{100}\right)^2 \times 20$$

Where T is the surface tension of the milk, and *m* is the % water in the milk. This equation gives quite satisfactory results.

The effects of various impurities, such as starch, sugar, flour, etc. have also been studied.

The practical use of this discovery has also been discussed in detail.

66. The Air flow Method of Measuring the Specific Surface of Jute.

M. M. ROY *and* M. K. SEN, Calcutta

An apparatus for measuring the specific surface of jute has been constructed. The specific surface of jute as obtained from measurements by using the air flow method is ca 1000 cm^2/cc, which agrees with the value derived from microscopic measurements. The value of the proportionality factor K of the Kozeny equation employed for the purpose is 5.17, being higher than the values for cotton, wool, etc., but coincides with the value for granular beds, such as, sands, cements, etc. The cause of the high proportionality factor for jute is under further investigation.

67. A Note on the Specific volume and the Porous Structure of Jute.

M. K. SEN

On the basis of Hermans' theory and using the specific volume figures for jute due to Macmillan and Sen, and those for pure cellulose fibres as given by Hermans, some deductions have been made about the porosity of jute fibres. The true specific volume of jute is 0.696 cc/gm against 0.645 cc/gm for cotton or ramie, and the difference is not due to lack of penetration of solvent (carbon tetrachloride) in the lumen area. The only explanation that can be put forward is that the solvent penetrates the lumen but fails to do so into some other void spaces in jute. The fact that water penetrates these spaces is indicated from the figure for the specific volume of jute in water, 0.641 cc/gm. It appears, therefore, that the void space in jute is composed of hydrophilic structure. In the case of rayon, Hermans has shown that the specific volume is related to the proportion of amorphous cellulose. Comparing the excess volume (relative to cotton) per 100 gms of jute, 5.1 cc with that of rayon, 1.6 cc, it can be seen that the void space is much greater than that in rayon. Since the proportion of crystalline cellulose in jute is about the same as that in rayon as shown from the background analysis of the X-ray diagram by Sen and Hermans, the cause of the extra space should be sought in some other factor besides amorphous cellulose. Lignin in combination with hemicelluloses may provide such open structures located, perhaps, in the region including and bordering the middle lamella. Some such indication is already obtained in the X-ray and microscopic studies of jute.

68. Suction and Compression by Lungs.

D. V. Gogate *and* G. Z. Shah, Baroda.

In this paper the action of human lungs is compared with that of the ordinary suction and compression pumps. Two simple experiments are described, one in which lungs are used for sucking in air from a large flask and the other in which they are used for compressing air. The results of these experiments clearly show that the usual formula for the pressure (or density) of air in the receiver of an air pump after a certain number of strokes of the piston, is completely verified in the case of lungs also.

69. Thermo Electromotive Force in single Crystals of Molybdenite

Ajit Kumar Dutta, Calcutta

An account of the measurements of the thermo-electromotive force of copper-Molybdenite-copper couple from room temperature to a temperature of about 200°C is reported. The molybdenite sample was a long single crystalline flake of sufficient thickness. Within the range of temperature the thermo e.m.f. per degree $\frac{dE}{dT}$ has been found to be practically constant and this is also the case in the lower temperature range. Moreover, $\frac{dE}{dT}$ is very high—higher than in usual metals and this indicate as useful clue to the construction of a low-temperature thermo-couple.

70. The Vibration of a circular membrane Symmetrically loaded at the Centre.

K. C. Kar *and* B. N. Bose

In the present note the problem of vibration of a circular membrane symmetrically loaded at the centre has been studied. Two special cases have been considered —(1) when the load is a circular plate of uniform thickness and (2) when the load is a spherical ball. The frequency-equations for the loaded membrane in these two cases have been derived.

71. Theory of Consistency of Soil

S. P. Baidya, Calcutta.

When water is added to dry pulverised clay soil and the mass is mixed thoroughly, the mass passes from cohesive solid to plastic then to fluid state. Applying the idea of film formation among the particles and taking into account the weight of particle and its surface water the force of tension between two particles in the direction θ to the horizon may be represented thus

$= 4\alpha - \left\{\left(\frac{\rho_1}{3}\gamma_1 + 4\right) + \left(\frac{\rho_2}{3}\gamma_2 + l_2\right)\right\}$ Sin θ where α is the force per unit area with which water adheres to the surface of a soil particle α depends on chemical nature of particle surface and the viscosity of water $\rho_1, \rho_2, l_1, l_2, \gamma_1$, & γ_2 are the densities, the thickness of water films and radii of the two particles (assumed to be spherical). When $\rho_1 = \rho_2 = \rho;\ \gamma_1 = \gamma_2 = \gamma;\ t_o = 8\left[\alpha - \left(\frac{\rho}{3}\gamma + l\right)\text{Sin }\theta\right]$ Now if $t_o \doteq 0$, $\alpha \leqq \left(\frac{\rho}{3}\gamma + l\right)$...... There are, therefore, maximum limit of the size of the particles which with the minimum thickness of water film will have no force of tension between them.

72. Measurement of the Consistency of Soil

S. P. BAIDYA, Calcutta.

If Q be the quantity of water and x, W_ρ, and W be the dry weight in grams of clay, particles other than clay and soil per c.c. of a plastic mixture then $Q = 1 - \frac{W}{S} = U_x x + U_\rho W_\rho + Qp$ where U_x, U_ρ .. are the quantities of surface water per gram of dry clay and particles other than clay in the mixture s is mean sp. gr. and Qp is free water per c.c. excess over surface water. We have shown in our discussion on the theory of consistency that $l = (R - \gamma)\frac{\rho}{3}$ it may be shown $U = \left(\frac{R}{\gamma} - 1\right)$ where U, γ, l...... all refers to particles in general U_x is positive for cohesive particles and negative for non-cohesive particles, U_x and U_ρ all depend on the force of tension measured by t_o. Further, it may be shown $Q_p = Q_{p0}\frac{1-Q}{1-Q_{p0}}$ where $Q_{p0} = (\beta^s - 1)/(\beta^3 - 1 + s)$ β depend on the force of tension, Q_p is the quantity of water per c.c. in the pores, when the film of surface water reduces to zero. Then, $Q = Q_{p0} + (U_x X - U_\rho W_\rho) + (1 - Q_{p0})$ or $W_\rho = \left[(1-Q_{p0}) - x(1-Q_{p0})\ U_x + \frac{1}{s}\right] \Big/ \left[\frac{1}{s} - U_\rho(1 - Q_{p0})\right]$

73. "Change of state of Consistency of Soil"

S. P. BAIDYA, Calcutta.

In the disturbed state of plastic soil mass the thickness of water film round the mean particle of the soil is same everywhere over its surface. In the quilibrium condition of the soil mass this thickness in the direction θ to the horizon is $l_0' = l_h\ \rho_0 - \text{Sin }\theta$...... and the force of tension in the same direction is $t_o = t_h - \left(\frac{8}{3}\rho\gamma_\beta + l\right)\text{Sin }\theta$ .... where $\rho_0 = \frac{l_h}{t_h}\left(\frac{8\rho}{3}\gamma_\beta + l\right)$ l_h and t_h are the thickness of water film and force of tension in the horizontal plane. $t_h = 8\alpha$.... and therefore constant. If R be the distance from centre to the surface of its water film of a particle then the area occupied by the particle and its water film in the vertical to the area in the horizontal plane is $\frac{L_o - \rho_1}{L_o}$ where $L_o = \gamma_\beta + l_h$ let $e = \frac{L_o - \rho_0}{L_0}$ .... Then when e is less than 1 the mass is in the plastic state, when $e = 1$ the mass is in the solid state. Let $R_h = \gamma_\beta + \frac{3}{\rho}l_h$ where R_h refers to the force of tension in the horizontal plane.

$\text{Sin}\ \theta = 0, \left(\frac{8}{3}\rho\gamma_{\beta} + l\right)$ is not zero so R_h is not zero. R_h depend on $\gamma\beta$ and l_h.

So $e = 1 - \frac{l_h}{t_h}\left(\frac{8}{3}\rho\gamma_{\beta} + l\right) \Big/ \left(1 + \frac{\gamma_{\beta}}{R_h - \gamma_{\beta}}\right)$ So e changes with the change of γ_{β} when R_h is constant. Then for the same force of tension the plastic shape of a soil depend on $\gamma\beta$. When $e \underset{-}{\Omega} 1$; $e = 1 - \frac{l}{t_h}\left[\left(\frac{8}{3}\rho\gamma_{\beta} + l\right)\left(\frac{R_h}{\gamma_{\beta}} - 1\right)\right]$

This explains the change from plastic to soi state of sandy soil at a very thin film of surface water while the same change of clayl soil at comparitively thick film of surface water.

74. Force of Consistency of Soil.

S. P. Baidya, Calcutta

Now $t_0 = Fl$, where $F = \frac{t_u}{l_u}$; F is termed as the force of consistency. It is independent of the direction in which the force of tension is measured. Further $t_e = \frac{t_u}{l_u}(R_e\ \gamma_{\beta})\frac{\rho}{3}$

When t_e is maintained constant R_0 remains constant. Therefore, change in γ_0 causes change in the force of consistency. Thus the force of consistency is independent of the force of tension. The force of tension in a direction θ to the horizon decreases with the increase of R_0 irrespective of the changes in the size of the mean particle. Therefore when the force of tension changes with the change of θ, but remains same in the same direction, irrespective of the changes of the size of the mean particle, the force of tension in any direction in a plasticmixture increases as the volume described by the revolution of the arc$R_0 = \gamma_{\beta} + \frac{3}{\rho} l_e$....decreases. If V_1 be this volume then

$$v_1 = \frac{2}{3}\pi\left[\left(\gamma_{\beta} + \frac{3}{\rho}\ln\right)^2\left\{2\left(\gamma_{\beta} + \frac{3}{\rho}\ln\right) - \frac{9}{2\rho}\cdot\rho_0\right\} - \frac{9}{\rho^2}.\rho^2\left\{2\left(\gamma_{\beta} + \frac{3}{\rho}\ln\right) + \frac{9}{4\rho}\cdot\pi\cdot\rho_0\right\}\right]$$

V_1 may be termed as elementry zone of tension. The force of tension corresponding to a volume V_1 disappear in a soil when V_1 is smaller than the occupied by its mean particle and its minimum mean thickness of water film

75. Vector hardness of diamond and diamod tools.

P. K. Kichlu *and* Harsh Vardhan, Delhi

The variation of hardness of diamond with the direction of crystal axes though fairly well known has often been incorrectly described. There is thus considerable lack of appreciation of the use of diamond tools in many technical processes in laboratories. It is due to this cause again that misleading statements are sometimes made that from different localities show difference in hardness. A diamond is by for the hardest substance known and its crystals roughly rounded in shape. each point on the surface of diamond must be worked by a unique process. A study of different types of tools which are being used in industry has been made and points which make for the superiority of one type over another are discussed in terms of the vector hardness.

Description of a machine for generating cylindrical surfaces on diamonds is given.

76. On making photographic developers

Mela Ram, Delhi

For spectrographic work the author had to develop photographic plates and papers at irregular intervals using developers of different compositions. It was found inconvenient to make fresh developers every time. A way has been worked out by which

six standard solutions are first prepared. These are such as will keep over long periods. Every solution is given a multiplication factor which determines the volume of the solution required to give the desired percentage of the chemical in a given developer formula.

The method is very convenient and saves a great deal of time otherwise wasted.

77. The change of the Magnetic Anisotropies of Potassium Permanganate with the variation of temperature.

BHAGAVATI CHARAN GUHA, Calcutta.

In potassium permanganate, the manganese atom should have the argon configuration with seven electrons in the 3d shell, and should be diamagnetic. If the atom be regarded as having lost all its seven electrons, and is Mn^{7+} ion, we shoud expect the crystal to be diamagnetic. That the paramagnetic susceptiblity of the crystal is extremely small, corresponding to mean $p^2 = 0.25$, at room temperature, as obtained by A. Mookherji, conforms to this prediction. The fact that there is left over a feeble paramagnetism need not occasion surprise, since the assumption of the presence of the Mn^{7+} ion is only an approximation.

The absolute value of the susceptibility being so small, its temperature variation could not be measured with our experimental arrangement; we could measure only the anisotropies. The anisotropies. $\chi_a-\chi_b$ and $\chi_a-\chi_c$ plotted against temperature give almost straight lines; they increase 2.4 and 1.6 times respectively, as we pass from 300°K to 80°K. It is difficult to estimate how much of the observed feeble anisotropy of the crystal is due to diamagnetism.

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SECTION OF BOTANY

PRESIDENT: PROF. P. MAHESHWARI, D.Sc., F.N.I.

Cryptogamic Botany and Plant Pathology

1. On the Occurrence of Endospores in Oscillatoria Synopsis.

B. N. MULAY, Pilani.

Endospore formation is rare in Nostocales and still more so in *Oscillatoria*. Endospores have been observed in a species of *Oscillatoria* found at Dudh-Sagar (Goa). There may be one, or two, or four endospores in a cell without any partition walls between them. They are liberated by the cell wall becoming mucilaginous.

2. *On Chlorogloea Fritschii* N.Sp. from Indian Rice-Field Soil.

A. K. MITRA, Allahabad.

Chlorogloea Fritschii N. Sp. formed a deep blue-green crust-like stratum on soil in cultures of desiccated soil samples from rice fields near Allahabad. The life-history of this alga has been studied in uni-algal cultures on both solid and liquid media. The growth consists of large loosely arranged superposed packets of round chroococcoid cells easily visible to the naked eye. Cell division takes place along three planes.

Any cell can produce a single naked endospore which it liberated through a wide irregular opening of the envelope which subsequently collapses and becomes folded. These endospores germinate to give rise to a short, straight or slightly curved filament of three to twelve cells. Subsequently cells of the filament begin to divide along planes at right angles to the first in three directions, obscuring the prostrate filamentous juvenile condition. The relationship of this alga is discussed. It is pointed out that the presence of a prostrate juvenile condition in *Chlorogloea Fritschii* lends support to the derivation of Pleurocapsales from the Entophysalidaceae which was so far doubted by Fritsch due to lack of any evidence of the occurrence of a juvenile filament in the latter.

3. *On Chloranomala Palmelloides* Gen.Et.Sp. Nov. From Indian Rice Field Soils

A. K. MITRA, Allahabad.

The palmelloid colonies of this alga appeared as a thin light green film on the surface of solution in cultures of desiccated soils from rice fields near Allahabad. The alga was grown in unialgal cultures both on liquid and agar media and its life-history studied.

The cells are surrounded by a hyaline mucilage layer and possess a light green parietal chloroplast with a posterior pyrenoid. Starch and a few oil drops are present. The first division in soon followed by the second in a plane at right angles to the first. When transferred to water the daughter cells wriggle out as naked highly metabolic biflagellate swarmers. Meanwhile the starch is mostly converted into numerous globules which give all the tests for oil. These swarmers also behave as facultative gametes. They conjugate in pairs after clump formation and form quadriflagellate zygotes which come to rest, secrete mucilage and divide into four daughter cells.

4. Observations on the Algae of Manured and Unmanured Soils and on the Effect of Different Culture Solutions on their Growth.

Ella A. Gonzalves and Kusum S. Gangla, Dharwar.

This investigation is an attempt to study the effect of manuring on the nature and quality of the algal population in soils as also whether the culture solution used has any effect on algal growth. Liquid and moist cultures were made of soils obtained from Niphad from an unmanured wheat field and from one manured with groundnut cake. No growth was observed in the moist cultures but the same algae were found in the liquid cultures of both soils. To determine the actual number of algae in each sample, counts were made by the dilution method of Skinner. The probable number of algae per gram of soil was found to be almost the same in both soils. Other workers have observed increased numbers of algae in manured soils.

As the moist cultures showed no growth it was presumed that some element necessary for algal growth was lacking in the soils. In order to determine whether the nature of the nutrient solution would affect the nature of the algal flora, different culture solutions viz. Knop's Beijerinclis, Bristol's, Benecke's and Molisch's were used instead of sterile water for preparing the moist cultures. Benecke's and Bristol's solutions were most favourable for algal growth. In the former however, blue-greens flourished, in the latter both greens and blue-greens were found. Liquid cultures of the same soils corroborated the results.

5. Studies in Indian Ricciaceae—I.

Ram Udar, Lucknow.

The present communication includes an illustrated account of the following 4 Indian species of *Riccia* Mich. occurring in Lucknow and its vicinity during monsoon months:—(1) *Riccia discolor* L. et L. (2) *R dictyospora* Howe. (3) *R. gangetica* Ahmad. (4) *R. melanospora* Kashyap.

This study clearly shows that *Riccia himalayensis* St. (as described by Kashyap in the Liverworts of the Western Himalayas and the Panjab Plains-I) is a composite species embracing *Riccia discolor* L. et L and *R. dictyospora* Howe. The two species differ in (1) habit, form and colour of the thallus, (2) sexuality, (3) spore size and sculpture, and several other taxonomic details

6. South Indian Hepatics—II.

S K. Pande and Ram Udar, Lucknow.

An illustrated account of the following seven species from Pfleiderer's collection is given:—

1. *Ptilidiaceae*: (1) *Herberta capense* St. (2) *Herberta pinnata* St.
2. *Radulaceae*· (3) *Radula javanica* G.
3. *Lejeuneaceae*: (4) *Ptychanthus striatus* Nees. (5) *Ptychanthus nietneri* St.

(6) *Thysananthus rotundistipulus* St., and (7) *Taxilejeunea tenerrima* St.

The species were mostly determined by Stephani and are included in his Species Hepaticarum (Vols. IV and VI), Four of these (1,3,4, and 5) are recorded for the first time from South India. Only *Ptychanthus striatus* Nees has been previously described in some details in publications on Indian Bryology.

7. On East-Himalayan Hepatics—I.

V. SCHIFFNER, VIENNA AND S. K. PANDE, Lucknow.

The following list comprises of 138 species of hepatics representing 45 genera and 20 families collected by Rev. P. Decoly and Schaul from the neighbourhood of Kurseong in the district of Darjeeling varying in altitude from 5000'—7000'.

Determinations were made by V. Schiffner, Stephani and Pande. There are about a dozen new species, about half a dozen new varieties and many new records for the province and the Country. In some cases, *e.g.*, (1) *Megaceros,* (2) *Notoscyphus,* (3) *Jackiella,* (4) *Euosmolejeunea* etc., these represent the first records of the genus from India.

8. Embryology of *Sewardiella Tuberifera* Kash.

P. N. MEHRA AND A. L. KHANNA, Amritser.

The vegetative body of *Sewardiella tuberifera* has saddle-shaped appearance consisting of thick central midrib and two flattened wings. Often the thallus is dichotomously branched.

The older ventral region of the midrib is invariably profusely infected by an unseptate fungal mycelium which is probably in symbiotic relationship with the species. It forms thick-walled vesicles which often fill the entire cavity of the cell. The apical cell is tetrahedral with three cutting surfaces. Apical tubers are the means of perennation during winter.

The plants are strictly dioecious. The antheridia are scattered on the dorsal surface of the midrib, each growing in the axil of a bract but occasionally more may be present in the axil of a larger bract. They originate from the segments of the apical cell and thus are strictly a cropetal. Development is of the usual Jungermanniales type.

The archegonia are aggregated on the dorsal surface of the midrib in the form of a cluster which is surrounded by free bracts on all sides. Younger and other archegonia occur mixed. Development follows the usual Jungermanniales type. The neck is composed of 5-8 rows of cells. Up to nine neck canal cells have been observed. The venter is only one layer of cells thick before fertilization.

The bell-shaped perianth develops by a common basal zonal growth carrying the involucral bracts above, which not only form the lacerated margin of the cup but also occur on the inside and outside of the cup. Strictly the perianth is thus of composite nature.

Mother cells of the spores and claters belong to the same cell generation. Spore mother cell protoplast is four-lobed and gives rise to spore tetrads by the deepening of the invaginations.

Foot is bulbous of Douin's generalised type with its basal cells haustorial in function. The capsule wall has three to four layers, all showing bands of thickenings on the radial and inner walls. The spores are reticulate lamellate. The claters are small in size and bi or tri-spiral.

The haploid chromosome number is nine and the diploid eighteen.

9. Prothalli of *Lygodium Japonicum* Sw. and *Ancimia Rotundifolia* Schrad.

T. S. MAHABALE AND H. Y. KULKARNI, Bombay.

The prothalli of *Lygodium japonicum* were obtained both in nature and in culture. The spores germinate readily when fresh but soon loose their vitality. The adult prothallus is formed after about 25 days in culture and consists of a flat heart shaped prothallus with two large rounded lobes. The meristem consists of a few cells at the notch. The cushion is about three cells thick. The embryonic plants are formed in about 40 days. The development of the archegonia and antheridia is normal. The opercular cell of the antheridium is circular surrounded by another eccentric cell. The prothalli germinated in culture were similar to those obtained in nature.

The prothalli of *Aneimia rotundifolia* were obtained by germinating the spores in various culture media and produced a much branched filamentous alga-like prothallus. There are about five branches on the primary filament emerging from the spore, each one having a distinct growing point of its own. The adult prothallus is multilobed and diffuse in form.

A comparative study of the anatomy of *L. flexuosum* Bedd. and *L. japonicum* Sw! showed that the primary underground stem is protostelic in both the species with plenty of pith mixed with xylem. It becomes multi-arched in the vertically growing twining stem, passing through an intermediate anchor-shaped stage having four protoxylem groups arranged more or less in the form of "X" reminding one of the configurations met with in the leaf traces of Zygopteridineae. The leaf trace in both the species comes out as an abstriction of the circular stele. The pinna traces come out marginally from the leaf traces.

10. A Contribution to the Study of the Genus *Cheilanthes*.

T. S. Mahabale and J. J. Shah, Bombay.

The genus *Cheilanthes* is represented by three species in the Bombay Presidency. They are *C. farinosa* Kaulf., *C. Tenuifolia* Sw. and *C. albomarginata* Clarke. For an account of the prothalli of the first two species (see *Proc 36th Ind. Sci. Congr.*, 1949, Part III, p. 125). The present paper gives an account of the prothalli in *C. albomarginata* growing in the Western Ghats under extremely xerophytic conditions. A comparative account of the anatomy of the three species is also given.

The spores germinate readily, the first division being transverse, giving rise to a rhizoidal and a prothallial cell. One or two rhizoids arises generally from the basal cell. The rhizoids are long and zigzag. The primary filament consists of six to seven cells and is followed by three to four horizontal branches which ultimately form an irregularly lobed prothallus. There is no single apical cell in the prothallus.

A comparative study of the anatomy of the stem showed that the stele in the three species is variable varying from solenostele to dictyostele with two to three overlapping gaps. The leaf trace is single, and is Y-shaped at the base. The two arms of xylem are broadly extended and curved with two protoxylem groups at the ends. The pinna trace is marginal. The anatomy of the leaf shows strong xerophytic characters, particularly in *C. albomarginata*. In this species, among other characters, there is a compact three-layered palisade tissue, not present in the other two species.

11. Germination of the Spores and Adult Prothalli in Culture of *Ceratopteris Thalictroides* Brongn.

T. S. Mahabale and S. R. Javalgekar, Bombay.

The prothallus of *Ceratopteris thalictroides* Brongn. has been generally described as unisexual by earlier workers. One of us has already shown that under natural conditions the adult prothalli are hermaphrodite in this species. It was, therefore, thought worth-while to germinate the spores and to see what kind of prothalli are obtained in culture.

The spores germinated readily in Knop's solution and after they had reached a certain stage were transferred to a thin layer of soil spread over bricks watered from below. A very small proportion of the prothalli was small and filiform and bore numerous antheridia near the apical parts ; but a great majority of them were large and formed both antheridia and archegonia. The shape of the prothallus varied from filiform to cordate with symmetrical or asymmetrical lobes. The number of lobes varied from three to four. The archegonia were formed behind the notch and below the meristem. The antheridia were placed marginally or submarginally but in both the cases they were found embedded in the tissue of the thallus. The embryos develop normally. The prothalli in culture are thus either hermaphrodite or male.

12. Cytology of Apogamy and Apospory in *Doodia Aspera.*

P. C. Sarbadhikari, Calcutta.

Within recent years some light has been thrown on the facts and meaning of sexual fusion and the correlative process of meiosis. But the cyclically recurring events, generally known as alternation of generations, are still vague owing to lack of convincing evidence. Considerations of this kind have attracted the writer to a study of apospory and apogamy with special reference to the cytological aspects of the problem.

The embryo arises apogamously as a direct vegetative outgrowth from the prothallus. Both the sporophyte and the apogamous gametophyte arising from it have the unreduced number of chromosomes. From this it is evident that apospory is balanced by apogamy. When apospory has occurred in the life-cycle, an apogamous development seems the only way of continuing the life-history.

13. Comparative Anatomy of Indian Ephedras.

G C. Mitra, Calcutta.

In India *Ephedra nebrodensis* Tineo, *E. gerardiana* Wall., and *E. intermedia* Shrenk & Meyer form the source of Ephedrine. The first two species contain about 60 to 70 per cent Ephedrine in the total alkaloids and the last about 10 per cent. The species present very little difference in external characters. Anatomically *E. nebrodensis* and *E. intermedia* present differences in : (1) the nature and development of the fibers ; (2) differentiation of the cortex ; (3) development of mesocortical fibers ; (4) development of secondary xylem from the interfascicular cambium ; and (5) presence or absence of isolated fibers around the inner margin of the xylem strands.

The fibers, in general, are fewer and less lignified in *E. intermedia* and the mesocortical fibers do not form a second series in the cortex. Further, the cortex is differentiated into an outer layer of palisade cells and an inner spongy parenchyma, while such differentiation is not noticeable in the other species. The large amount of secondary xylem produced from the interfascicular cambium obliterates the wedge-shaped character of the primary xylem in *E. intermedia*, while in the other species it is not lost even after secondary growth. In the latter species isolated groups of fibers are found around the inner margin of the xylem strand while they are absent in *E. intermedia.*

Other species of *Ephedra* are under investigation.

14. The Embryo Sac and the Embryo of *Helixanthera Ligustrina* (Wall.) Dans.

B. M. Johri and P. Maheshwari, Delhi.

There are no ovules or nucelli in the usual sense. Several megaspore mother cells differentiate from a mass of parenchyma cells in the centre of the ovary. The basal megaspore functions. The upper part of the embryo sac grows into the style and reaches into the stigma. It shows the egg apparatus (consisting of two synergids and the egg) and the upper polar nucleus. Five or more embryo sacs grow at the same time in a style. The lower part of the embryo sac which remains in the ovary shows the three antipodal cells and the lower polar nucleus.

The first division of the oospore is vertical, followed by a number of transverse divisions resulting in a long biseriate proembryo which continues its growth downwards into the style until it reaches the ovary. Several proembryos grow in the same style and reach the ovary. The endosperms produced by the embryo sacs in their lower part fuse and produce a composite structure, which fills the central portion of the ovary and in which all the descending embryos are embedded. Ultimately only one of the embryos develops further. The downward extension of the endosperm is checked by a collenchymatous pad of cells at the base of the ovary and its further growth is therefore on the margins of the pad rather than towards its base.

15. Intracarpellary Pollen Grains in Trillium.

B. M. JOHRI AND A. M. EUNUS, Delhi.

Three species of *Trillium*—*T. erectum, T. grandiflorum, T. sessile* and *T. sessile* var. *giganteum*—have been studied. The tricarpellary syncarpous pistil shows a single loculus in the upper part of the ovary and three loculi in the lower part. The style shows a tri-radiate stylar canal and the stigma lobes have numerous glandular hairs.

The mature pollen grain is two-celled. Pollen grains were seen on the stigma of ovaries having two-nucleate embryo sacs.

The wall of the ovary shows numerous air spaces. Pollen grains have frequently been observed in the wall of the style, aerenchymatous tissue of the ovary wall, and also inside the ovary. A few germinating pollen grains were also seen inside the ovary (*T. grandiflorum*) and in the stylar tissue (*T. erectum*).

Since intraovarial pollen grains were first discovered by one of us in *Butomopsis*, similar pollen grains have also been reported in some other plants. Whether they can bring about fertilisation has not been observed but such a possibility can not be ruled out.

16. A Contribution to the Life History of *Acalypha Fallax.* **Muell Arg.**

I. BANERJI, Calcutta.

The development of the microspores is of the simultaneous type. The haploid number of chromosomes is 21 and the tapetum is of the secretory type. The embryo-sac develops in a tetrasporic manner and the mature gametophyte conforms to the *Acalypha indica*-type. Variations in the organization of the mature gametophyte have been recorded.

17. A Contribution to the Life History of *Melochia Corchorifolia* L.

C. VENKATA RAO, Waltair.

Tapetum is of the plasmodial type and develops from the innermost layer of the five cells thick another wall. Microspore tetrads are tetrahedral and cytokinesis is by furrowing. Mature pollen grains are spherical, smooth-walled, 2-nucleate and show three rectangular germ pores.

Archesporium of the ovule is multicellular though only one cell functions usually. The chalazal megaspore of the linear tetrad forms the 8-nucleate embryo sac.

Fertilisation is porogamous. The triple fusion nucleus forms the endosperm which is nuclear in the beginning and becomes cellular later.

Embryo development corresponds to *Asterad*-type. The fertilised egg divides transversely. The apical cell divides longitudinally and the basal cell transversely. The penultimate cell divides again transversely and the embryo develops from the three terminal cells, the lowest remaining as a 1-celled suspensor. The terminal tier forms stem tip and cotyledons ; the second cell gives rise to hypocotyl and the third to the root tip. The suspensor cell cuts off a hypophysis cell which fills out the dermatogen of the root tip and root cap.. The embryo is straight and its cells like those of the endosperm get filled with starch grains.

The outer integument forms a membranous cover ; the outermost layer of the inner integument develops into the palisade layer.

18. The Embryology of *Dendrophthoe Falcata* (Linn. fil) Ettingshausen.

BAHADUR SINGH, Agra.

Floral parts arise in acropetal succession, i.e., the calyculus appears first and is followed by the perianth, androecium and gynoecium. The vascular supply of the flower is based on a pentamerous plan, their being no traces to the calyculus. One bundle enters each perianth lobe and divides into three to five strands. The stamens also receive a single trace. The remaining five bundles enter the style and may divide to form as many as ten bundles in the stigmatic region.

Microsporogenesis and the development of the male gametophyte follow the usual course. Pollen grains are shed at the bicelled stage. The generative cell divides after it has travelled an appreciable distance in the pollen tube and shows clear spindle fibres accompanied by cell plate formation resulting in two oval male cells.

Megasporogenesis and development of the female gametophyte show several interesting features. The archesporium originates in the hypodermal layer at the base of the ovarian cavity. Several layers of cells below the archesporial tissue and near the base of the ovary there is a pad of collenchymatous cells.

The tetrads of megaspores are of the linear type. Anyone or more of the megaspore of a tetrad, excepting the topmost, may function.

On account of the gliding growth of the megaspores and the resultant gametophyte the ovary cavity gradually becomes obliterated.

The mature embryosac is greatly elongated. It has a normal egg apparatus and the upper polar nucleus in its upper end, and three ephemeral antipodal cells and the lower polar nucleus at the lower end.

Further elongation of the embryo sac continues at both ends, following a meandring course which is often very pronounced in the ovary. The antipodal end of the embryo sac finally reaches down to the pad of collenchyma, while the upper swollen end, containing the egg apparatus, enters the stylar canal so that the two ends may be 22-28 mm apart in a straight line. As many as eight to ten embryo sacs may be seen in the stylar canal.

The endosperm is of the cellular type and begins development in the lower part of the sac. As soon as one of the embryos, growing downwards from the style, touches the pad of collenchyma endosperm cells divide rapidly. Finally owing to a dissolution of the separating walls of the embryo sacs all the endosperms fuse to form a composite mass containing the embryos. The first division of the fertilised egg is longitudinal and later divisions are transverse resulting in a long biserate suspensor. As the pro-embryo grows down the style there is another longitudinal division in the two terminal tiers resulting in a row of four cells at the apical end, the rest of the pro-embryo remaining biserate. No further longitudinal divisions take place until the pro-embryo has reached the pad of collenchyma. As a rule only one embryo reaches maturity while the others degenerate. On account of the subsequent fusion of the two cotyledons the mature embryo appears to be monocotyledonous. Its radicle end protrudes outside of the endosperum while the rest is embedded in its tissue.

The fruit is a pseudo-berry and has a characteristic viscid layer which brings about the ejection of the seed.

19. Behaviour of Antipodals in the Embryo Sac of *Fumaria Parviflora.*

H. B. SAKSENA, Gwalior.

The mature embryo sac is eight-nucleate and shows an egg apparatus (consisting of two synergids and and egg), the upper and lower polar nuclei, and three antipodal cells. The latter show a very abnormal behaviour which is reported here.

Soon after the egg apparatus has been organised, the antipodal cells enlarge and simulate the appearance of the egg apparatus so much so that unless one knows whether he is observing the micropylar or the chalazal end, the three antipodal cells may be mistaken for the egg apparatus.

In post fertilization stages the antipodal cells greatly enlarge and their nuclei become amoeboid and lobed. Later the muslin break up and the fragments become distributed in the cytoplasm. Finally the cell walls lose their sharpness and the amalgamated protoplast of the three cells shows irregularly scattered fragments of chromatin. Before the embryo has well advanced and the differentiation of the cotyledons has been initiated from the globular embryonal mass of cells, the antipodal protoplast becomes absorbed.

The endosperm is free nuclear. Wall formation starts from the periphery inwards when the embryo is still quite young.

The young proembryo has a very prominent and massive suspensor nearly four times longer and twice as broad as the embryo proper. It appears like a bunch of grapes whose cells are gorged with starch grains and have large nuclei.

20. Studies in Umbelliferae. I. *Foeniculum Vulgare,* Mill.

J. S. AGRAWAL, Delhi.

Germination of the seed is epigeal. One cremocarp on germination produces two seedlings both of which develop to maturity. The inflorescence is an ebracteate compound umbel with about sixteen umbellates arranged in 3—5 whorls comprising a total of about 250 flowers. After the initiation of the bud the flower takes 21 days for opening. The calyx is rudimentary, the petals remain incurved, the stamens straighten out one by one and it takes approximately 43 hours for the process of opening of the flowers and shedding of the petals and stamens. The flowers are protandrous and mostly insect pollinated. The frequency of insects visiting the umbels is at a maximum between 9. 30 A. M. and 11. 30 A. M.

The young anther shows three wall layers of which only the fibrous endothecium persists at maturity. Normally there are four pollen sacs in each anther which sometimes show a tendency to enlarge and constrict so that each sac appears two-lobed but it never completely divides. The archesporial tissue is a hypodermal plate of cells in each lobe. The tapetum is glandular and multinucleate, and persists until the formation of the pollen grains. The quadripartition of the microspore mother cell takes place by furrowing. Isobilateral and tetrahedral tetrads are formed. The pollen grains are ellipsoidal and three celled at the time of shedding. Each shows two elongated sperm cells one lying at each pole.

The ovules are anatropous, unitegmic and tenuinucellate. The archesporium consists of one to several cells. No parietal cell is cut off. The embryo sac is eight-nucleate.

21. Life of *Coriandrum Sativum* L.

Ripusudan Lal Paliwal, Agra.

The inflorescene is a compound umbel. Each umbellate comprises five to six whorls of flowers. Those of the outermost whorl, which are zygomorphic, and the central flower which is actinomorphic, alone are fertile, while all the flowers of the intermediate whorls, which show a decreasing amount of zygomorphy from outside inwards, are sterile.

Development of the male gametophyte proceeds normally in all flowers. The young microspore is pear-shaped, which soon becomes ellipsoidal. In earlier stages its nucleus lies at one end. Subsequently it travels to the equatorial region where it divides to form a vegetative and a generative cell. The generative cell divides either in the equatorial region migrates to one of the two poles where it divides either the two male cells one of which migrates to the opposite pole. At the time of shedding, the pollen grains are three-celled with a tube nucleus in the equatorial region and two elongated sperm cells lying one at each pole.

Three to ten archesporial cells originate in the nucellus. Of these only one or two function as megaspore mother cells. Both linear as well as T-shaped tetrads of megaspores are formed. The chalazal megaspore generally functions to form a normal eight-nucleate embryo sac. A mass of dark-staining cells (hypostase) is present in the lower part of the ovule.

There is well marked gradation in the extent to which the sterile flowers develop. The innermost whorl of sterile flowers degenerate at the megaspore mother cell stage. Those of the next outer whorl may show early stages of division of megaspore mother cell, and those of the outermost whorl of sterile flowers go up to the megaspore tetrad stage.

22. Development of the Female Gametophyte and Endosperm in *Glossostigma Spathulatum.*

K. M. Safeeulla, Bangalore.

The archesporial cell functions directly as the megaspore mother cell, and the development of the embryo sac conforms to the *Polygonum* type. Double fertilisation occurs.

The first division of the primary endosperm nucleus is followed by the laying down of a transverse wall. The chalazal chamber does not show further nuclear divisions and directly functions as the chalazal haustorium. The first division in the micropylar chamber is vertical and the second is transverse, resulting in two tiers of two cells each. Of these the upper develops into the two-celled micropylar haustorium, and the two cells of the lower undergo further divisions to give rise to the endosperm proper.

The micropylar and chalazal haustoria are of the non-aggressive type. In the mature state, the micropylar haustorium is constituted by two uninucleate cells, while the chalazal haustorium remains one-celled and uninucleate. The formation of the embryo is belated and it develops after the differentiation of the endosperm.

Phanerogams

23. Studies in the Embryology of some Members of the Bignoniaceae.

H. C. GOVINDU, Bangalore.

An account of megasporogenesis and endosperm formation in *Jacaranda mimosaefolia* D. Don., *Parmentiera cerifera* Seem. and *Tecoma stans* (L.) H. B. K. is presented. Development of the female gametophyte of *Kigelia pinnata* DC. is also included. The development of the floral parts has been studied in case of *T. stans*.

The floral parts of *T. stans* arise in acropetal succession, the anterior members of each whorl always preceeding the posterior ones in development.

The ovary is superior, bicarpellary and bilocular. The numerous ovules are usually anatropous or raeely amphitropous and are borne on the axile placenta. The ovules have a single massive integument. Its innermost layer forms the integumentary tapetum which surrounds the non-dilated chalazal portion of the embryo sac. A nutritive tissue of radiating cells is present, at the chalaza. The embryo-sac is of the '*Polygonum*-type' The synergids are hooked and show pointed apices. The antipodals are organised as definite cells.

The endosperm is cellular and conforms with minor variations to the *Catalpa*-type of Mauritzon. The chalazal haustorium is aggressive and four-celled in *J. mimosaefolia* and *T. stans*, and two-celled in *P. cerifera*. In contrast, the micropylar haustorium is weakly developed. It is four-celled in *J. mimosaefolia* and two-celled in the other two forms. In *P. cerifera*, however, the two topmost cells of the endosperm become tubiform in late stages.

24. The Embryology of *Cistanche Tubulosa* Wight.

B. TIAGI, Ajmer.

Cistanche tubulosa is a large parasite occurring on the roots of *Calotropis* and *Acacia*. It is found on sandy dunes in the months of January and February only. The stamens become pseudo-syngenesious by the interlocking of the hairs formed by the proliferation of the epidermal cells of the anthers. The ovary is unilocular with four massive, parietal T-shaped placentae. The floral parts develop in acropetal order. The anther is a four-lobed structure with one crescent-shaped pollen sac in each lobe. The archesporial tissue consists of a group of hypodermal cells. The tapetal cells are radially elongated, binucleate and of the glandular type. They degenerate by the time microspores have been formed. Sometimes two or more layers of tapetum can be distinguished in a lobe. The quadripartition of the microspore mother cells takes place by furrowing resulting in tetrahedral, iso-bilateral and decussate type of tetrads. At the time of sheeding the pollen grains is two-celled, three-furrowed and with a smooth exine.

The ovules are tenui-nucellate, unitegmic and anatropous. The innermost layer of the integument forms a nutritive jacket around the developing embryo sac as the single-layered nucellus degenerates. Ultimately in the seed the nutritive jacket becomes cutinised and surrounds the endosperm. There is one hypodermal archesporial cell in each ovule. It functions directly without cutting a partietal cell. The embryo sac is of the *Polygonum* type. The antipodal cells are persistent but the synergids disappear soon after fertilisation. The polar nuclei fuse to form a large secondary nucleus. Fertilisation is porogamous and the endosperm is cellular.

The first wall in endosperm formation is transverse resulting in a micropylar and a chalazal chamber. The nucleus of the chalazal chamber divides but once and forms a weak one-celled, two-nucleate chalazal haustorium. The micropylar chamber divides by a longitudinal wall. The next division in this chamber is transverse delimiting the two micropylar haustorial cells from the middle tier, which by further transverse and longitudinal divisions gives rise to the endosperm proper. The micropylar haustorium is very aggressive and draws food materials by hypha-like branched processes penetrating the integument. The endosperm contains starch and oil. The proembryo has a long four-to five-celled suspensor which disintegrates and the mature embryo is an undifferentiated mass embedded in the endosperm. The minute seeds are produced in abundance. The cells of the testa are large and reticulately thickened. Majority of the seeds are sterile.

25. Life History of *Cucumis Melo* L. Var. *Pubescens.* Willd.

RIPUSUDAN LAL PALIWAL, Agra.

The pollen grains of *Cucumis melo* L. var. *pubescens,* germinated in sugar-agar concentrations of 2.5%, show frequent branching of pollen tubes. The individual branches grow for an appreciable length. Some pollen grains also showed a slight tendency towards the polysiphonic condition.

The embryo sac develops according to the *Polygonum* type. Functioning megaspores with only two degenerating cells situated above were also observed. In such cases the upper cell is the undivided dyad cell.

The ovule has two integuments of which the inner is crushed and destroyed at the apex by the growth of nucellar beak. The pollen tube enters the embryo sac by destroying the cells of this nucellar beak.

26. Embryo Sac and Endosperm in *Lavenhookia Dubia* Sond in *Lehm.*

K. SUBRAMANYAM, Bangalore.

Lavenhookia dubia is a member of the family Stylidiaceae, material of which was obtained from Melbourne, Australia.

The ovary is inferior, unilocular, with a large number of anatropous ovules borne on a basal globose placenta. The ovules at the base of the placenta are amphitropous. Multicellular glands borne on biseriate stalks are present on the outer wall of the inferior ovary.

Megasporogensis proceeds normally and the development of the embryo sac follows the *Polygonum* type. Occasionally a T-shaped tetrad is met with and the upper dyad cell shows a belated division. The mature embryo sac is long and tapering at both ends. Its lower portion is surrounded by an endothelium. The synergids are elongated, exhibit characteristic hooks and rarely a filiform apparatus. The egg is pear-shaped. The antipodals are organised as definite cells, with their ends pointed below. A case was met with, which in the pointed ends of the antipodals had penetrated in between the cells of the chalazal tissue, thus behaving as weak antipodal haustoria. The embryo sac develops a small process at the chalazal end. Double fertilisation has been observed.

The endosperm is cellular and it follows the *Scutelaria* type of Schnarf. The micropylar haustorium is made up of two uninucleate cells which develop short processes penetrating between the cells of the integument. The chalazal haustorium is also two-called and gives rise to long tubular prolongations which grow up in between the cells of the integument.

27. The Embryo Sac of *Fritillaria Liliacea*

J. S. AGRAWAL, Delhi.

The trilocular ovary has numerous anatropous bitegmic ovules arranged in two longitudinal rows on an axile placenta in each loculus. The hypodermal archesporial

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cell functions directly as the megaspore mother cell without cutting off any wall cell. It undergoes the usual reduction divisions and produces four free megaspore nuclei lying cross-wise or in a linear row in the same cell. The two central (or lateral if arranged cross-wise) nuclei move towards the chalazal end resulting in a 1 + 3 stage. The two groups of nuclei divide simultaneously. The micropylar nucleus produces two haploid daughter nuclei whereas in the chalazal region the three spindles fuse and result in two triploid nuclei. The two micropylar nuclei undergo another division; out of the four daughter nuclei thus produced, three organise into an egg apparatus and the fourth is the upper polar nucleus. Out of the two triploid chalazal nuclei the basal usually degenerates while the upper elongates and divides once to produce the lower polar nucleus and a single antipodal cell. The lower polar nucleus enlarges while the antipodal cell soon degenerates. Thus the mature embryo sac develops according to the *Fritillaria* type and is seven-nucleate.

Frequently the basal nucleus of the secondary four nucleate stage fragments to form three or four nuclei. In such cases as many as 6—7 antipodal cells may be seen.

28. Occurrence of Peristent Pollen Tubes in the Ovles of some Angiosperms.

P. Maheshwari and B. M. Johri, Delhi.

Pollen tubes frequently persist in the micropylar part of the ovules of *Hydrilla, Ottelia* and *Boerhaavia* for a long time after fertilization. Some workers who have also observed similar pollen tubes in other plants conclude that these are haustorial structures which transmit food material to the growing embryo. Our observations indicate that soon after fertilization the pollen tube appears as a densely staining organ without a nucleus or active cytoplasm which are the usual signs of a haustorium., It appears, therefore, that such pollen tubes are merely dead strutures which persist for a long time but are quite functionless.

29. Seasonal and Regional Variations in Shape, Size and Structure of Pollen Grains—I.

T. C. N. Singh and A. T. Natarajan, Annamalainagar.

Investigations during the past one year on the pollen grains of eighteen species spreading over twelve families (*e.g.* Nyctaginaceae, Capparidaceae, Caesalpineae, Papilionatae, Euphorbiaceae, Vitaceae, Tiliaceae, Combretaceae, Apocynaceae, Scrophulariaceae, Rubiaceae and Compositae) have shown that pollen grains exhibit variations in shape, size and structure both in time and space:

I. Seasonal variations in size and shape of pollen grains, (from Annamalainagar) have been found in *Bougainvillaea spectablis* Will., *Gynandropsis pentaphylla* DC., *Caesalpinia pulcherrima* Swartz., *Abrus precatorius* Linn., *Clitoria ternatea* Linn., *Allamanda cathartica* Linn. and *Hamelia patens. Jacq*-Enum.

II. Seasonal variation in structure of pollen grains in addition to their shape and size (from Annamalainagar) has been found in *Abrus precatorius* Linn.

III. Regional variations in size and shape of the pollen grains (from Annamalainagar, Tambaram and Nagpur) has been found in *Gynandropsis pentaphylla* DC., *Caesalpinia pulcherrima* Swartz., *Abrus precatorius* Linn, *Jatropha glandulifera* Roxb., *Quisqualis indica* Linn., *Allamanda chathartica* Linn., *Vinca rosea* Linn., *Angelonia grandiflora* Hort., *Hamelia patens* Jacq-Enum, *Olden-landia umbellata* Linn. and *Tridax procumbens* Linn.

IV. Regional variation in shape of pollen grains (from Annamalainagar and Banaras) has been found in *Morinda tinctoria* Roxb.

V. Regional variation in structure of pollen grains in addition to their shape and size (from Thirumyiladi and Vellore) has been found in *Cissus quadrangularis* Linn.

The significance of these variations is discussed.

30. Anatomy of the Haustorium of *Dendrophthoe Falcata* (Linn. fil) Ettingshausen.

BAHADUR SINGH, Agra.

The haustorium develops from the radicle end of the seedling which pierces into the stem of the host. Curiously enough the vascular bundles are collateral, open, endarch and arranged in the form of a compressed ring as in phylloclade, the plane of compression being parallel to the longitudinal axis of the host.

A number of massive sheathes arising in acropetal succession receive the vascular supply from the marginal bundles of the compressed ring. These sheathes, which like the rest of the tissue of the haustorium, are formed for the most part of parenchymatous cells, spread into the tissue of the host forming the woody swelling, known as the "burr".

31. The Origin, Development and Morphology of the Intrapetiolar Stipules of *Tabernaemontana Coronaria* Br.

G. C. MITRA, Calcutta.

By transverse extensions at two particular sectors of the free apex the opposite primordia are initiated at the same time and their production appears to exhaust the former for further laying down of primordia with the result that it becomes a cup-shaped structure. At the end of a fairly long plastochrone the apex becomes convex again when another pair of primordia is laid down. The shape of the free apex, concave or convex, is thus indicative of the beginning or the end of a plastochrone when primordia are being laid down in the vegetative bud.

At the earliest stage the primordium consists only of a base (axial component); with the lateral extensions of the latter the free limb is erected which is unsegmented and undifferentiated. Meanwhil the axial components of the opposite primordia extend tangentially around the free apex until their lateral ends meet and fuse to form a tubular sheath around the apex with which it grows united for some time. In a transverse section of the terminal bud the axis is seen to consist of a peripheral mantle composed of the leaf-bases (axial components) and an axial core of vacuolating dividing cells completely enclosed by the former.

After being free from the axis the sheath continues a free tubular upward growth for some distance when it separates into the two free bases.

The stipule is formed by the separation of the arms along with the adaxial portion of the central region of the free base as a single piece. It contains 4 branches—all derived from the laterals. Homgeneity of the tissues of the stipule does not support the contention of Goebel that a new formation connects the pair of free lateral stipules to form the axillary stipule in this case. The upgrowth of the adaxial portion of the central region of the base along with the lateral portions in the formation of the stipule is continuous, and as a result the middle portion of the stipule cannot be distinguished from its wings. The branches close by influence this upgrowth.

Three bundles enter each primordium as a single trace, and leave a single gap in the nodal ring. The laterals, however, separate from the median in the axial component and give out 8 slender branches during their upward differentiation. These branches unite in pairs and form 4 bundles which arrange themselves along the inner face of the central region of each free base. These 4 bundles form the stipular trace.

The origin of the stipule in this case differs from the other types in the fact that not only the arms but also the adaxial portion of the central region of the free base takes part. Their formations are influenced, as in all the other types of stipules, by the branches of the laterals.

32. Notes on the Anatomy of Peduncles in Palms.

T. S. Mahabale and N. N. Udwadia, Bombay.

Peduncles are generally recognised the more conservative part as among flowering plants. To the best of our knowledge, the anatomy of peduncle in palms has not been worked out, although a good deal of work has been done on the anatomy of the stem. The peduncles of some twenty species of palms belonging to different genera were studied anatomically and it was found that they present some significant characters for understanding the structure and taxonomy of fossil and living palms. The shape of the fibrovascular bundles, particularly in peduncles, is not such a reliable guide to taxonomy as some other characters, as it varies from the base to the apex of the peduncle. The more reliable characters for this purpose are to be found in the structure and distribution of the ground tissue as pointed out by Sahni, Kaul and others.

33. Floral Anatomy of Some Malvales and Geraniales and its Bearing on the Affinities of the two Orders.

C. Venkata Rao, Waltair.

In Sterculiaceae the writer found that contrary to the description commonly given, the androecium consists of outer antipetalous fertile and inner antisepalous sterile whorls. To correlate the findings with other families, the floral anatomy of the following plants was studied and the results embodied in the paper: (*a*) Malvaceae—*Malvaviscus arboreus, Hibiscus rosa-sinensis, Bombax malabaricum;* (*b*) Tiliaceae: *Triumfetta rhomboidea, Corchorus acutangulus;* (*c*) Geraniaceae: *Oxalis corniculata.*

In all the Malvales studied, the fertile whorl of stamens is found to be antipetalous with traces in common with those of petals, just as in *Oxalis* where typical obdiplostemony is seen. In some Sterculiaceae an inner sterile whorl is seen which is suppressed in Malvaceae and Tiliaceae. The numerous stamens in these families are the result of branching of the outer whorl. Restriction of the number of stamens of each whorl to five would naturally result in typical obdiplostemony. This fundamental uniformity in the anatomical structure of the flowers brings the Malvales and Geraniales closer to each other. Sterculiaceae is found to contain some primitive pentacyclic flowers and a suggestion is made for the derivation of the other floral types in Malvales from them.

34. Studies in the Morphology of a new Species of *Abrus*.

C. Srinivasan, Annamalainagar.

Abrus precatorius, Linn., has till now been recognised and represented in the Indian flora as having red and white seeds. Taxonomic and morphological studies of the seed-coat, leaves, epidermal characters, inflorescences, flower colour, time of flowering, and anatomical studies of the stem, root, petiole, pulvinus, leaflets have all been found to be so different in the plants raised from red and white seeds that the white seeded *Abrus* should be given the status of a separate species. The name *Abrus natarajansis* sp. nov. is proposed for this after Lord Nataraja of Chidambaram.

35. A Contribution Towards the Study of the Dispersal Mechanism in Flowering Plants of Mysore (South India).

BASHEER AHMED RAZI, Bangalore.

In a recent paper the author (Razi 1946) gave a check list of the flowering plants of Mysore embodying the field survey carried out for several years. An attempt was made to indicate the life forms on the basis of Raunkiaer's system. Studies on the dispersal mechanisms of the flowering plants of Mysore were also taken up with a view to get a better understanding of the plant distribution. Two main groups of dispersal mechanisms are recognised; the "ACTIVE" and the "PASSIVE", depending on whether the plant is directly concerned in modifying its fruit structure to suit the mode of dispersal, or whether an extraneous agency partakes in this process. Plants having the active mode include those with explosive fruits and others showing a mechanical contrivance for dispersal. The second category includes plants dispersed through the agency of wind, water, animals etc.

36. Pharmacognostical Studies of the Leaves and Stems of *Andrographis Paniculata* Nees.

G. C. MITRA and S. N. BAL, Calcutta..

'Kalmegh' of the Indian Pharmacopoeial list contains the dried or fresh leaves and stems of the plant *Andrographis paniculata* Nees. It is used as a substitute for Quassia and 'Chiretta' and the latter is very often adulterated with 'Kalmegh'.

Pharmacognostical characters of the leaves and the stems of *Andrographis paniculata* have been investigated to find out the distinguishing features. Cystoliths are present in the epidermals cells only of the leaves and stems. They occur singly but rarely in pairs. They are either round or elongated in shape with blunt ends. Stomata are present only on the lower epidermis and are associated with two subsidiary cells which are placed transversely to the stoma. The stem is quadrangular. Collechymatous cells are present at the corners and are patches below the epidermis. Interxylary and intraxylary phloem are absent. The xylem consists mostly of wood prosenchyma with scattered vessels.

The values for palisade ratio (4), stomatal index (26), vein-islet number (4), number of epidermal cells per sq. mm. (283) and of stomata per sq. mm. of (78) have been determined.

The leaves and the stems contain 6.08% and 1.07% respectively of crude andrographolide. The proportion of stems in the crude drug should not exceed 10%.

37. The Leaf-base and the Internode: their True Morphology.

G. P. MAJUMDAR and G. C. MITRA, Calcutta.

In our text-books and manuals of Botany by *leaf primordium* is meant the usegmented papillate outgrowth at the side of the apical dome ('primordialblatt' of Eichler) which can be distinguished into two parts, namely, an upper (oberblatt) and a lower ('unterblatt' or 'blattgrund') not on any visible symptoms but on the share they take in later development. According to this idea the *leaf-base* is the region of the leaf by means of which it is attached to the axis (region of insertion) unless the base is specially formed, such as, the pulvinus, leaf-sheath, etc.

Our developmental studies of 14 species of plant (dicotyledons) show that in the origin of a leaf primordium the first part to be laid down at the shoot apex is the *axial component* (*soubassement foliares,* Gregoire) of the primordium which in all cases is incorporated in the axis, and on this the primordium, *i.e.* the free limb, is erected under the influence of the acropetally differentiating median and the lateral trace bundles in the desmogen stage. This axial component is a part of the leaf, and *is really its base.* The result of our studies lead us to conclude: (1) the axial component is an integral part of the leaf and it forms its base; (2) when the whole of it remains incorporated in the axis for a comparatively short length (leaf cushion) and free for a considerable length, the free portion of the base is sheathing, as in *Bacopa monieria, Polygonum orientale,* etc.

The above observations lead us further to the question of the nature of the *internode.* In serial transections of the terminal buds in all the species studied the axis in bud is seen to consist of a peripheral *mantle* composed of the axial component or components (leafbases) enclosing an *axial core.* The axial core and the mantle are derived from two different zones of apical meristem, namely, the file meristem and the flank meristem respectively. The axial core corresponds to the pith, and the mantle includes the entire region outside it. Thus the Berindung Theory of Hofmeister (1851) is revived with some modifications of the Leaf-skin Theory of Saunders (1922).

38. Investigations on Indian Jasmines of Commercial Value.

AMIYA DATTA, Calcutta.

The paper deals with systematic account of 12 species of Jasmines of commercial value, which may be used in the enfleurage of pure jasminum oil in India. All the species taken into account have either strong or feeble smell. It is asserted that the best yielder of the essential oil may be had from *Jasminum grandiflorum* Linn. (Chameli). *Jasminum sambac* Ait. and *J. auriculatum* comes as second and third as regards the quality of perfume they yield. The result is correlated with the actual findings by enfleurage experiments carried out in the laboratory of the Tata Oil Mills Co. Ltd. A key has been drawn for the classification of those 12 species. The commercial value and the market rate of Jasminum flowers and the possibility of use of these flowers in the Essential oil industry of the country has also been discussed.

39. Studies on Comparative Anatomy of Indian Acanthaceae (Epidermal Cells and Stoma).

AMIYA DATTA, Calcutta.

The epidermal cells are mostly thin walled with outer thick covering, excepting in *Acanthus illicifolius* and a few others, where they are thick walled. Preponderance of tangential and vertical divisions of epidermal cells are met with in *Eranthemum* and few others. Some of the cells of the epidermis are a bit bigger and lodges within them crystals of calcium carbonate (cystolith). These may be called cystalith-sacs. These are absent in *Thunbergia, Nelsonia, Acanthus, Asystasia* and *Aphelandra* where no cystoliths are found.

Stoma are present is young stems of all the plants examined and specially in angular or furrowed stems, e.g., *Andrographis, Phlogacanthus, Dicliptera* etc., where the stoma are arranged in vertical rows throughout the length of the stem in furrowed position.

40. Studies on Comparative Anatomy of Indian Acanthaceae, (Epidermal Hairs).

AMIYA DATTA, Calcutta.

The general structure of epidemal hairs are thickwalled, uniseriate and pitted, of varying number of cells and of different shapes. The speciality is found in *Aphelandra* in which it consists of one linear long thick walled tip cell with two basal small cells;

in *Thunbergia* the hair is unicellular, thickwalled, short hook-like; in *Nelsonia* they are thin, membranous many celled with the tip cell thickened; in *Jacobiana* the hairs are multicellular, uniseriate, small cells with thick walls.

41. Studies on Comparative Anatomy of Indian Acanthaceae (Glands).

AMIYA DATTA, Calcutta.

The glandular structures in all the 32 species studied can be classified into two general types of non-stalked external glands of different sizes. The first type which is found in *Thunbergia* and *Nelsonia* are panduriform and bicellular glands with one vertical wall or disc shaped and the second type which is found in the rest of the species are unicellular or multicellular with more than one vertical wall.

42. Identification of a Few Important Indian Leaf Drugs.

S. C. DATTA AND R. L. DESAI, Calcutta.

Crude drugs, as sold in the Indian market in broken or powdered state are often found adulterated or some other drug is substituted for the genuine one. Common botanical methods of identification by morphological characters are of no value in this case. Nine leaf drugs viz., *Datura metal.* L., *D. fastuosa.*, L., *D. stramonium,* L., *Solanum nigrum,* L., *Solanum xanthocarpum,* Sch. & W., *Adhatoda vasica, Nees.*, *Andrographis paniculata, Nees.*, *Trianthema monogyna,* L., and *Boerhavia diffusa,* L., have been studied. It has been found that vein islet numbers, vein islet appearence and appearence of the veins on the upper and lower surfaces of the leaves are important factors in the identification of leaves from dry powdered or crushed samples. The vein islet numbers in *Datura* species vary from 13.2 to 20.9, in *Solanum* species from 21.9 to 26.3, in *Adhatoda,* 7.1, in *Andrographis* 12.2, in *Boerhaqvia* 4.8 and in *Trianthema* 6.8.

43. Pharmacognostic Studies on Roots and Rhizome Drugs of India.

S. C. DATTA, Calcutta.

According to the Ayurvedic system of medicine, a number of drugs obtained from the roots of many Indian plants, are reputed to be efficacious. The identification of these crude drugs from commercial samples is very difficult as they are sold in dry state in powdered or broken condition. Botanical identification by morphological characters can not be applicable to these as they are incomplete specimens and possess no reporductive organs which are considered the main factor in the classification. Pharmacognostic characters of 56 root and rhizome drugs, distributed over a large number of families of Dicotyledons and Monocotyledons have been studied. For each particular drug, a number of data, viz. synonyms, vernacular names, source, habitat, standard, macroscopic and microscopic characters of roots and rhizomes and their powders, chemical constituents along with action and uses, have been dealt with. A map regarding distribution of these drugs in India have been worked out. After a careful consideration of the anatomical structures of roots, and rhizomes and their microchemical tests, the author has brought out a schedule for identification of these drugs and their features. The work is considered to be of value to drug dealers, manufacturers, drug inspectors, and students, for ascertaining the identity and purity of the drugs.

44. Pharmacognostic Studies on *Vitex Trifolia* Linn. An Insect-Repellant Plant.

S. C. DATTA, Calcutta.

The plant *Vitex trifolia* Linn. has been found by the author to possess strong insect-repellant properties. The plant is non-poisonous and is therefore of special value in the preservation of food grains, like cereals, rice etc. About 10 gms. of dry powdered leaves per pound of food grains, i.e., about 1 seer of dry leaves per maund of food grains was found sufficient for preservation of food grains from the attack of insects Experiments on preservation of food grains was done with rice and gram and it was also found that it is well applicable to other food grains like wheat, jowar etc. The macroscopical and anatomical characters along with microchemical tests and results of qualitative chemical assay has been presented in this paper. The insect-repellant properties are attributed to the presence of a highly aromatic essential oil in the leaves. Chemical assay showed the presence of tannins, reducing sugars, glucosides, plant mucins and saponins, along with resinous matter and aromatic essential oil which are the chief constitutents.

Mycology and Plant Pathology

45. Studies in the Occurrence of Bacteria in the stem and Leaves of Plant—I.

T. C. N. Singh and V. R. Rajagopalam, Annamalainagar.

A study during the last one year has demonstrated the occurrence of bacteria in the following thirty-one species of plants of the local flora:

(1) *Typha angustata* Bory. and Chaub., (2) *Cyperus rotundus* Linn., (3) *Scirpus articulatus* Linn., (4) *Monochoria hastaefolia* Paresl., (5) *Ficus religiosa* Linn., (6) *Salicornia brachiata* Roxb., (7) *Sesuvium portulacastrum* Linn., (8) *Nymphaea pubescens* Willd., (9) *Polyalthia longifolia* Hook., (10) *Cleome viscosa* Linn., (11) *Gynandropsis pentaphylla* DC., (12) *Neptunia oleracea* Lour., (13) *Glycosmis cochinchinensis* Pierre., (14) *Mangifera indica* Linn., (15) *Sonneratia apetala* Buch.-Ham., (16) *Rhizophora mucronata* Lamk. (17) *Bruguiera caryophylloides* Blume, (18) *Lumnitzera racemosa* Willd., (19) *Memecylon umbellatum* Burn., (20) *Aegiceras majus* Gaertn., (21) *Bassia latifolia* Linn., (22) *Allamanda cathartica* Linn., (23) *Ipomoea aquatica* Forsk., (24) *Lippia nodiflora* Michux., (25) *Clerodendron inerme* Gaertn., (26) *Avicennia officinalis* Linn., (27) *Martynia annua* Linn., (28) *Acanthus ilicifolius* Linn., (29) *Ixora coccinea* Linn., (30) *Pavetta indica* Linn. and (31) *Marsilia* sp.

A full description of each species is recorded with illustrations; and the significance of the occurrence of bacteria is discussed and explained.

46. A Case of Apparent Symbiosis of *Lagerstroemia Flos Reginae* Retz, with *Marasmius Campanella* Holt.

S. R. Bose and Miss. Parul Chatterjee, Calcutta.

Lagerstroemia flosreginae is a common roadside tree in Calcutta and other towns. Every year during the rains a large number of tiny fructifications of *Marasmius campanella* comes out on the bark of the main trunk and of the older branches of adult trees, the younger branches of adult trees as well as very young plants being free from it. The health of these trees is not affected. The observation has been extended for 10-12 years on large number of trees from different parts of Bengal and this year the same fructification has been collected from some trees of the Bombay City. Sections of the stem, root, shoot apices, flower stalks, seed-coat etc. of such adult and young plants revealed abundant hypha in all healthy trees throughout the year, in fact in every part of the plant . On dipping a branch in water, crops of tiny fructifications come out after a lapse of 2-3 months.

The fungus has been grown from spores in pure culture in tubes where it has formed small fruit-body of *M. campanella* after a lapse of 2-3 months.

Further work to locate the fungus in funicle and the placenta inside the ovary and in freshly germinated seedlings is proceeding.

47. A note on the Occurrence of Mycorhiza in *Aristolocia Bracteata* Retz.

S. VENUGOPALAN, Annamalainagar.

An anatomical study of *Aristolochia bracteata* was made and it was found than an endophytic mycorhiza inhabits the rhizome, stem and leaves. It was also observed in the wall of young ovaries just prior to the organisation of the axile placenta. The mycelium is found in profusion in the parenchymatous cells of the cortex, pith and medullary rays of rhizome and stem and also in the spongy parenchyma of the leaves. Hyphae are occasionally seen to protrude out of the surface of the rhizome in tufts. This is believed to be the first record of a mycorhiza in *Aristolochia.*

48. Survey of the Antibiotic-Producing *Penicillium* Sp. from the Soils of West Bengal.

P. N. NANDI, Calcutta.

Since the discovery of penicillin, microbiologists have taken up the problem of surveying the occurrence and distribution of antibiotic-producing micro-organisms.

The work reported here was undertaken to survey the penicillin-producing moulds from the soils of West Bengal. Up to the present time 48 samples of soil have been investigated and 250 strains of *Penicillium* isolated from dilution plates. They were grown on Czapek-Dox medium with Corn steep liquor and filtrates were assayed against *Staph. aureus* and *B. coli* as test organisms.14 strains inhibited *Staph. aureus* alone and 4 inhibited both *Staph. aureus* and *B. coli.* The maximum diameter of the zone of inhibition was 22 mm in one case (F. 1. 10). which is equivalent to approximately one unit of penicillin per millilitre of the medium.

49. *Arachniotus* Species within the Rhizomes of *Psilotum Flaccidum.*

M. J. THIRUMALACHAR, Banaras.

An *Arachniotus* species was isolated in culture from surface sterilized underground stems of *Psilotum flaccidum* plants grown in the Botanical Gardens, Central College, Bangalore. The fungus was first located in cross sections of the rhizomes, filling up the lumen of some of the outer cortical cells. In artificial culture, the fungus forms an effuse, white delicate mycelium, developing obovate to spherical, whitish cleistothecia, which are 1 to 2 mm. in length. The asci are numerous, 7 to 10 μ in diameter and 8-spored. Mature ascospores are oblong-ellipsoid, hyaline, mostly, 3.5 x 2.5 μ and thin-walled. The fungus is tentatively identified as *A. terrestris* Raillo, reported to be a soil inhabitant in Russia, though the ascospore measurements differ. Recent studies by Rosenbaum has shown that *Arachniotus* is related to Trichophytoneae of the dermatophytes, occupying a position between the Gymnoascaceae and the Aspergillaceae.

50. Notes on two Fungi Parasitic on Scale Insects.

M. J. THIRUMALACHAR, Banaras.

A fungus parasitic on scale insects collected on leaves of *Gymnosporia ovata* in Khandala was found on examination to be *Uredinella spinulosa* Couch and Petch. The genus *Uredinella* established by Couch is of great interest since it shows characters intermediate between the plant rusts and *Septobasidium.* The hymenium is composed of two types of cells, the teleutospores which are obovate to ellipsoidal, always borne on a pedicel, and somewhat elongated teleutospore-like cells which are however without distinct stalk cells. Some of the germination stages of the two spore forms have been studied.

An entomogenous fungus parasitising aleyrodoid insects on the leaves of *Murraya exotica* and *Trema orientalis* collected in Nandi Hills, Mysore, has been identified as *Aschersonia papillata* Petch. The fungus forms hard flattened stroma up to 2.5 mm in diameter, white along the margin and orange coloured in the centre. The pycnia are large. The pycnospores measure 10-15 x 1-1. 5 μ and often become spuriously one-septate. The fungus has been studied in artificial culture.

51. Effect of Sulpha-drugs on the Growth of *Pestalotia* Spp.

R. N. Tandon and M. P. Tandon, Allahabad.

Pestalotia spp. was isolated from rotten apples and mummified guavas. The isolate from apples is designated as P1 and that from guava as P2.

Asthana and Hawker's medium A without agar was used as control. Sulpha drugs —Sulphadiazine Sulphaguanidine, Sulphamerazine, Sulphanilamide, Sulphapyridine and Sulphathiazole—were added individually to the nutrient medium in concentrations of 0.025%, 0.05%, 0.075% and 0.1 %. The weight of the fungus after three weeks' incubation was used as a quantitative measure for comparing its growth.

Both the forms of *Pestalotia* spp. gave different results with different Sulpha drugs. Sulphanilamide and Sulphathiazole appeared to be most injurious, since on these the growth of the fungi was extremely poor. Sulphapyridine also supported only feeble growth, but fair amount of growth was observed on Sulphamerazine and Sulphaguanidine. On Sulphadiazine, however, excellant growth of P2 was observed being even better than on the control, though with P1 its injurious effects were quite pronounced.

Subsequent inoculation of the fungi on Oat meal agar or on medium A after their removal from the Sulpha drugs gave normal growth. Thus it was evident that wherever *Pestalotia* spp. showed a poor development it was only due to the Sulpha drug exerting a fungi static (not fungicidal) action which became more pronounced with increased concentrations.

Microscopic examinations revealed that some of the Sulpha drugs are capital of causing morphological abnormality in mycelium and spores of both P1 and P2. Production of long chains of chlamydospores of different colours was a common feature wherever poor growth was observed.

52. On the Leaf Spot Disease of *Citrus Acida* Var. *Variegata.*

J. N. Rai.

A blight disease of the leaves of *Citrus acida* var. *variegata* is conspicuous during the rainy season. The causal organism has been found to be a new strain of *Colletotrichum gloeosporides* penz., which attacks only the leaves of this particular variety of citrus. An effort to infect the leaves of other varieties and species of citrus has failed.

The results of the inoculation experiments under varied conditions, and the morphological description of the fungus are embodied in the paper.

53. The Enzymic Studies of *Alternaria Tenuis* Auct. Sensu Whiltshire, *Curvularia Lunata* (Wakker) Boed and *Fusarium Coeruleum* (Lib.) Sacc.

R. N. Tandon and J. P. Srivastava, Allahabad.

Investigation was undertaken to study some of the important extracellular and intracellular enzymes of *Alternaria tenuis, Curvularia lunata,* and *Fusarium coeruleum.* Both qualitative and quantitative tests were employed. The former included *in vivo* as well as *in vitro* methods.

A. tenuis responded positively for the following enzymes:

Lipase, butyrase, amylase, invertase, raffinase, maltase, emulsin, cellulase, hemicellulase, pectinase, proteolytic enzymes, erepsin and urease. However buty-rase was not secreted as extracellular enzyme. Out of all these, cellulase was produced in largest quantity.

C. lunata did not produce butyrase and proteolytic enzymes extracellularly and cellulase intracellularly. *F. coeruleum* did not liberate butyrase as extracellular enzyme and amylase, invertase and emulsin as intracellular enzymes. Enzymes, other than these enumerated to be present in *A. tenuis,* were also produced by these two organisms both intracellularly as well as extracellularly.

Rennatase, laccase, oxidase, peroxidase and Schardinger's enzyme were not produced by any of these three fungi.

54. Partial Vitamin Deficiencies in Four Strains of *Collelotrichum Lindemuthianum.*

R. S. Mathur, New Delhi.

The effects of thiamin, biotin, inositol and pyridoxine, were studied singly and in combination on the growth of four isolates of *C. Lindemthianum.*

All isolates tested were partially deficient in one or more vitamins. The *alpha* isolate was partially deficient in thiamin, the *beta* isolate had a very weak partial deficiency in biotin, *the gamma* isolate in inositol and biotin, and the *Preston county* isolate partially deficient pyridoxine, inositol and biotin. Thiamin alone was depressing for the *Beta, gamma* and *Preston County* isolates.

55. Nitrogen Requirements of *Alternaria Tenuis* Auct. Sensu Wiltshire and *Curvularia Lunata* (Wakker) Boed.

J. P. Srivastava, Allahabad.

Nitrogen requirements of *A. tenuis* isolated from wheat grains and *C. lunata* from guavas were studied. Asthana and Hawker's medium was used as the base. Potassium nitrate of that was substituted by a number of organic and inorganic nitrogenous compounds. In each case, the equivalent quantity of nitrogen was taken. It was observed that the two organisms behaved differently.

Greatest dry weight of *A. tenuis* was obtained with hydroxylamine. Potassium nitrite, cystine and cysteine hydrochloride did not support the growth at all. Ammonium compounds, urea, histidine, tryptophane and peptone had retarding effects.

Best growth of *C. lunata* was obtained on the basal medium (i.e. on the medium containing potassium nitrate); d-glutamic acid and asparagin gave more or less similar results. There was no growth on potassium nitrite. Poor growth was obtained on 1-aspartic acid, tryptophane and urea. The retardation was not pronounced with ammonium nitrate.

Plant Physiology

56. Fractional Analysis of Brick-Kiln Fumes and their Effect on the Mango Fruits.

G. S. Verma, S. C. Agarwala, J. N. Rai, and S. N. Iyer, Lucknow.

Brick-kiln fumes were passed into different organic solvents and the solvents distilled off. The 'residue' and its various fractions were separately injected into young healthy mangoes.

It has been found that the ether soluble and chloroform soluble constituents are able to induce the appearance of Black-tip disease in the mangoes. If fumes were passed in the healthy mango extract and the fluid was then injected in fruits, this also produced Necrosis at the tip region.

The details of analyses and effect of injecting different constituents in different variety of mangoes are described in the paper. It is believed that the results have an important bearing on understanding of the causation of mango Necrosis.

57. Effect of 2-4 Dichlorophenoxyacetic acid on Germination in *Sorghum Vulgare.*

V. K. DESHMUKH AND U. K. KANITKAR, Poona.

With the broader object of investigating the effect of plant growth promoting substances on Indian crops preliminary experiments were performed with 2.4 Dichlorophenoxy acetic acid on *Sorghum vulgare.* The seeds were treated with the substance in watery solutions at various concentrations viz., 2 ppm, 100 ppm. and 600 ppm. The time of treatment was varied from 5 minutes to 24 hours. The seeds after treatment were thoroughly washed with water and were then germinated on moist filter paper and in soil.

In Jowar No. 8, the strain used in the investigation, treatments with 100 ppm. for 5 minutes and 10 ppm. for 2 hours accelerated the growth of seedlings in soil as estimated at the end of 15 days. On moist filter paper 2 ppm, 10 ppm and 100 ppm for two hours showed a similar effect in ten days. In all cases treatment with 600 ppm. for any length of time was seen to retard the growth of the seedlings. It could also be seen that the treated seeds show a lesser activity in initial stages of germination than the untreated in both cultures. They however, grew faster than the controls equalising with them within 7 to 10 days and surpassing them in 10 days in filter water culture and in 15 days in soil. It is considered that the treatment increases the rate of growth of the seedlings probably affecting their internal metabolism.

58. Photoperiodic Induction and the Development of Growing Apex in Rice.

S. M. SIRCAR, New Delhi, and S. P. SEN, Calcutta.

In order to explain the photoperiodic response in rice noted by the senior author an investigation has been made of the changes occurring at the growing apex.

The vegetative apex of rice is very small and only a few mm. in length. A week's short day fails to produce any effect on the growing apex. With two weeks the photoperiodically sensitive ones show early stages of transition from vegetative to reproductive phase; after 3 weeks stages of inflorescence formation are noticed in large number of plants; and in 4 weeks all the apices become converted into axes bearing spikelets.

Prior to floral initiation groups of specialised cells with large nuclei and rich protoplasm are differentiated near about the protoderm. This is associated with a depression at the top of the apex. These groups of cells bulge out and later develop into branches of the inflorescence, bearing more than one spikelet. Stages of transition from vegetative apex to the structure bearing spikelets have been shown. Generally two tiller-buds are formed during the period of 6 weeks short day exposure and receive the stimulus; consequently the tillers formed from these two buds flower earlier than the remaining tillers. From the results presented in this work it appears that photoperiodic response and growing point development in rice are different from those of other cereals; and it is worth considering further, whether the sequence of reactions involved in the synthesis of flowering hormone as postulated by previous workers in the field fits in with the behaviour of this tropical crop.

59. Manures and Manuring of the Mango, and the Economics of Mango Culture.

P. C. MALLIK and B. N. DE, Sabour.

Nutritional requirements of the mango have been studied in Pot and field culture. Out of the three main vegetative flush during the year, the shoots of the earliest flush generally produce flower during the next year; the later ones, under normal conditions do not get sufficient time to ripen so as to bear during the next bloom.

Pot culture experiments with mango grafts in quartz sand revealed that N controls the intake of P and K and determines growth, and that P-requirement of mango is much lower than that of K. Mango is very susceptible to K-deficiency while it resists considerably the adverse effect of low P, the deficiency symptoms of which are manifested after a few years. Adverse effects of K and P can be remedied by replenishing the two elements in nutrient solution. Field experiments with fertilizers have confirmed these. Here N had significant effect in increasing growth, which reaches maximum under NPK. Soil and plant material analyses revealed that intake of K is increased in presence of N and vice versa. Also with greater N-take more of P of the soil is utilized but the reverse does not hold good.

Flowering and fruiting also vary with the growth.

N in the form of Am-sulph is most effective in increasing flowering and the best time for its application is June. Slow acting F. Y. M. applied in October has also beneficial effect, as it has given increased flowering over control. P-fertilizers are advantageously used if applied with the slow acting F.Y.M. or Green Manuring. It has been seen that Am. Sulph in June followed by FY.M in October, and both with K manures applied after ploughing are best for reproduction in Mango. An extra ploughing during winter rains is advantageous.

60. Some Experiments on the Transmission of the Photo-Periodic Stimulus by Grafting in Jute.

J. C. SEN GUPTA, Calcutta.

Clear evidences of the conduction of photoperiodic stimulus from photoperiodically induced plants to non-induced plants through grafts have been recorded in *Xanthium*, Soyabean, Beet and others and this has been taken as a strong evidence of the photoperiodic effect being associated with the production of substances of hormonal nature.

Some preliminary experiments were first tried to see how far Jute plants can be grafted successfully, and to find out whether the photoperiodic stimulus is transmitted from the induced donor plants to the non-induced receptor plants. The grafts were found to set without difficulty Two types of graft, splice graft and contact or approach graft, were tried.

In Jute, a short day plant, induction has been found to take place on 21 days exposure to 10 hrs. light period.

Grafts were made between plants exposed to 10 hrs., 14 hrs. and normal light period for 21 days, in different combinations of two as stocks and scions in the splice grafts and as the two components in the approach grafts. The plants were exposed to 14 hrs, 10 hrs and normal light periods in different cases after grafting.

It was found that the light period to which the plants were exposed after grafting had the greatest influence on flowering. Except in one or two cases no indication of the transmission of the flowering stimulus from the donor to the receptor plant was found, on the other hand the flowering was found to be delayed in the induced donor plants on grafting with a non-induced receptor plant.

61. Relation of Rate of Respiration and Enzymic Activity during Ripening of Alfonso Mango.

D. B. MAHAJAN and U. K. KANITKAR, Poona.

Changes in the rate of respiration and activity of peroxidase, oxidase, catalase and phosphatase in mango fruit during ripening were determined. The climacteric set in at the and of 2 to 3 days. With the arrival of the climacteric enzyme activity was seen to change suddenly. The peroxidase shows a decrease in activity during and after climacteric while oxidase and catalase activity increased during the same period. The phosphatase activity however was high only during the climacteric until the fruit was completely ripe. It was low in both pre-climacteric and also in over-ripened stage. This leads to the conclusion that phosphatase is responsible for initiation of chemical changes during ripening of fruit and it remains very active only during the period concerned with these changes. It is further suggested that the changes in peroxidase, ovidase and catalase activity depend on the change in chemical constitution brought about by phosphatase.

62. Effect of Treatment of Inflorescencess on Mango with Growth Promoting substances on Growth of Fruit and Embryo.

U. K. KANITKAR, Poona.

Inflorescences of Alfonso, payari and Raival varieties of mango were treated with various concentrations of B indolyl acetic acid, naphthalene acetic acid and 2-4, D. The effects of these treatments were estimated by changes brought about in growth of fruit and embryo.

The three varieties tested gave differential responses to the substances used. In no case could these substances induce parthenocarpy.

B indolyl acetic acid and naphthalene acetic acid did not affect the growth of fruit and embryo in Alfonso and Payari varieties. Similarly 2-4, D did not induce any response in the Alfonso. In the Payari variety however the weight of the embryo was reduced by 37 % under treatment with 10 ppm as compared to the untreated control, although there was no decrease or increase in the total fruit weight. The Raival variety was adversely affected by the application of 2-4, D as not only the fruit was much smaller but the weight of embryo was also reduced significantly.

63. The Effect of Pre-emergence Treatment with Hormonal Weedicides on the Weed Flora of an Uncultivated Field.

S. SOLOMON and M. V. V. RAO, Poona.

An uncultivated field was treated with three weedicides viz. Agroxone, Fernoxone and Weed-No-More. Three doses of each chemical were employed viz., 2 lbs. 4 lbs. and 6 lbs. of the active ingredients per acre Periodical observations were made on the appearance of weeds and two months after treatment all the weeds appearing in the different treatments were pulled out and weighed.

It was observed that the number of weeds in the treated plots was considerably reduced, greater reduction taking place as the dose was increased. There was practically a complete suppression of grasses and dicotyledons in the treated plots. *Cyperus rotundus* was suppressed during the first month after treatment. But in the second month *Cyperus rotundus* plants appeared in large numbers until at the time of harvest there was more *Cyperus rotundus* in the treated plots than in the untreated ones.

As regards the three chemicals used, it was observed that all of them have the same effect. But in the first month after treatment, it appears that Fernoxone and Weed-No-More suppressed the weeds more effectively than Agroxone.

64. The Osmotic Pressure of the Host and Parasite in Relation to the Nutrition of the Host.

S. Solomon, Poona.

While studying the influence of nutrition of the host on the susceptibility of *Andropogon sorghum* to attack by the phanerogamic root-parasite *Striga lutea* and *S. densiflora* the hosts along with the parasites were grown in sand cultures watered by four different concentrations of the same nutrient solution for a period of nearly five months *i.e.* from sowing to harvest. These studies were utilised for testing the ability of the parasite to adjust its osmotic pressure to that of the host.

From the results obtained it was found that the severity of attack was the highest at the lower concentration and lowest at the higher concentrations of the nutrient solution. Similarly, the damage done by *Striga* plants as determined by the reduction in yield of grain of the *Sorghum* plants was the greatest at the lower concentrations. The differences in yields of straw were not significant.

The osmotic pressures of the leaves of *Sorghum* plants, attacked by *S. lutea* and *S. densiflora,* and of free *Sorghum* plants were determined by the plasmolytic method. The osmotic values of the leaves of the parasites were measured at the same time. It was found that the osmotic pressure of the parasite was always much greater than its host at the lower concentrations but at the highest concentration, the host and parasite have practically the same osmotic pressure.

65. On the Uptake of Nitrogen by Three Varieties of Wheat.

R. D. Asana and T. J. Malkhani, New Delhi.

With a view to understanding the physiology of varietal differences as regards the uptake of nutrients by crop plants, a study of the growth and uptake of nitrogen in three varieties of wheat viz. N.P. 165, N.P. 52 and N.P. 710, was undertaken. Two levels of nitrogen (control and nitrogen added to the soil) were maintained in this study which was carried out under pot culture. Plant samples were collected on five occasions during autogeny. Varietal difference in grain yield and ear number, at both levels of nitrogen, was not found to be statistically significant. Grain number per ear and maximum tiller numbers were significantly lower, at both levels of nitrogen, in N.P. 165. The smaller grain number in N.P. 165 and N.P. 710 was however, compensated by larger grain size. N.P. 52 absorbed a greater amount of nitrogen than N.P. 165 and N.P. 710. The rates of uptake of nitrogen by the three varieties were more or less similar up to the first 78 days, but between 78 and 118 days it was much higher in N.P. 52 and this largely accounted for the ultimate high nitrogen content of this variety. Active tillering phase was already over by 78 days. The only other difference between the varieties consisted in the larger number of spikelets and grains per ear in N.P. 52. There was thus a greater number of centres in the ear of N.P. 52 for protein synthesis and apparently more nitrogen was, therefore, absorbed. The percentage nitrogen centent of the grain of N.P. 52 was also the highest. All the 3 varieties responded equally well to nitrogen.

Ecology

66. The Importance of Geology in the study of Vegetation.

G. S. Puri, Dehra Dun.

The physical geology of a region affects the vegetation on the surface in two ways :—

(1) by presence or absence of minerals and

(2) by structural variations in rocks and nature of the slope, viz., dip versus scarp slope.

The effect of the first factor has long been appreciated both in this country, and in Europe. That of the second factor is put forward for the first time. It determine the availability of minerals at different positions on a single bed and also determines the maturity of topography and soils in a uniform climate. For example, on scarp slope the minerals will be leached to other areas by seepage through the strata of the rock; and topography and soils will tend to remain in an immature stage. The dip slope in contrast will correspond to an enriched area and soils topography here will be comparatively more matured. On account of the fundamental differences in the soils and topography the scarp and dip slopes will bear different types of vegetation whose demands on soil minerals and water will be different. Thus, broadly speaking, on quartzite, sandstone or phyllite formations in the Parbati Valley, non-exacting and xerophilous communities are found on scarp slope while compartively exacting mesophytic communities occuprred on dip slope.

67. Ecological Approach to the Problem of Sal (*Shorea Robusta*) Regeneration in the United Provinces.

Part II—The Foliar Ash and Cao in Sal and its Common Associates in the Dun Valley.

G. S. Puri and A. C. Gupta, Dehra Dun.

Mature leaves of 67 common species from reserved sal forests of Lachiwala, Thano and Kansrao, were collected during Sept.-Oct. 1949, air dried and powdered. Each sample was drawn from 9-10 middle-sized trees growing in an area approximately of 100 square feet. Ash was determined with bunsen burners after oven drying the samples for 2 hours at a temperature of 650 C. CaO was determined by the usual oxalate method.

It was found that there is a good deal of difference in foliar ash and Cao in different species growing within a small region under uniform climatic conditions. Foliar Ca is an index of physiological requirements of species and it determines to some extent the development of surface layers of the soil and seedling growth. The data are of importance in the study of regeneration of different species.

68. Maturity of Canes under Flooded or Water-Logged Conditions in North Bengal.

T. C. H. Singh, Annamalainagar.

Observations on canes have shown that flooded or waterlogged condition, induces early maturity almost simultaneously in all the canes whether early, medium or late. In North Bengal, canes like *Co|313, 371, 421 527* and *331* were found to have matured fully in the flooded or water-logged areas of the districts of Rajshahi and Pabna as early as the first week of October a phonomenon unknown before! These observations were confirmed both under field conditions as well as under pot-culture experiments. Further the purity and MR of these samples was always found to be higher than that of samples derived from non water-logged areas.

69. Study of the Vegetation Found Round About Pilani.

B. N. Mulay and B. V. Ratnam, Pilani.

A list of plants occurring round about Pilani is given.

Typical sand plants belonging to the Chenopodiaceae, Salvadoraceae, Tamaricaceae and Euphorbiaceae and which are well represented in Sind and Western Rajputana floras, are absent from this locality.

Convolvulaceae and Verbenaceae are not well represented.

In Sind and Western Rajputana, October and November are the months for flowering for majority of plants. In Pilani most of the plants flower from July to September. This change of flowering time is most probably correlated with the favourable conditions for the germination of seeds.

In Pilani *Capparis—Prosopis* is the dominant association.

70. Sub-Alpine and Alipine Vegetation of the Sikkim Himalaya.

K. Biswas, Calcutta.

Since J. D. Hooker's visit to Sikkim a century ago—many botanists, mountaineers and tourists visited and collected plants from one of the world's best fields for sub-alpine and alpine flowers. Examination of these collections which are fairly large and good, however, show that it leaves much room for detailed study of the wonderful plants in and about the snowy regions of the Eastern Himalayas. In this region the Sub-alpine zone is generally well-marked between 8—10,000 ft. or say above 3,000 meters. The Alpines are seen in their best in the zone lying between 10 and 12,000 ft. that is at an altitude of roughly 4,00 meters. The zone above this is found to be of the nature "heath" formed by the smaller species of Rhododendron, Salix, Viburnums, Gentians, Primulas, and others and partly "subglacial fell-field with a mixture of herbaceous species." Results of my study of associations of these sub-alpines and alpines form the subject of this paper. Systematic enumeration of these species is also added to the paper.

71. Exchangeable Bases of Mangrove Soils.

F. R. Bharucha, and B. S. Navalkar, Bombay.

It was seen from previous investigations of various chemical factors of mangrove soils that neither pH nor Calcium carbonate nor the humus vary with the seasons or with different zones of the mangrove vegetation. These investigations failed to reveal the cause of zonation except perhaps that it is due to varying degrees of salinity or moisture of the soil. Therefore the reason for zonation was sought in another direction namely, in the exchangeable bases of the soil. Three distinct types of soils can be distinguished, each characterized by its own peculiar flora:

(*a*) The Ca-Mg Soil, with *Avicennia albea* as the predominating vegetation to the extent of exclusive covering by it;

(*b*) The Ca-Na Soil, characterised by *Acanthus ilicifolius* vegetation almost in pure stage;

(*c*) The Ca-K Soil, characterised by *Suadea fruticosa* vegetation and its few associated plants.

Hence it can be said that in determining associations the main considerations are the amounts of exchangeable bases present in the soils and therefore the exchangeable bases do seem to solve the difficulty of explaining differences in between various zones of vegetation.

72. Common Grasses Found Round about Pilani (Rajasthan).

K. R. Ramachandra, Pilani.

1. A list of grasses growing round about Pilani is given, with comments on ecological and other factors.

2. Typical psammophilous grasses found in the locality are *Cenchrus barbatus, Dactyloctenium aegypticum,* species of *Aristida, Eragrostis, Sporobolus* and *Saccharum.*

3. Mesophilous grasses, which are mostly annuals, occur around "pockets" of water collected during the rainy season, and in the sheltered spots beneath trees. Important among mesophilous grasses are *Paspalidium geminatum, Echinochloa colona, Brachiaria ramosa,* and *Urochloa panicoides. Digitaria marginata* may be included here, but it also occurs in the dry open "pastures."

4. Species of *Aristida* are not as abundant as could be expected, and *Heteropogon contortus* seems to be not represented at all. This is interesting in view of certain comments made by Burns, Kulkarni and Godbole (1928) on the distribution of the *Aristidas* in the grasslands of the Deccan.

73. Time of Application of Organic and Inorganic Manure on Rice.

A. K. Kar, Bankura.

An experiment was conducted at Rice Research Station, Bankura (lateritic tract) to find out the best time of application of Organic as well as Inorganic manure on rice. On Ajan 246, a transplanted low land Aman paddy which is very popular in the lateritic tract, two different kinds of manure (1) Organic—Mustard Cake (2) Inorganic Ammonium Sulphate, was applied at the rate of 40 lbs. Nitrogen per acre, during the three different times within the life cycle of the crop; (1) During puddling, (2) During weeding (*i.e.,* about one month after transplanting), (3) During Thormuck stage (*i.e.,* about a fortnight ahead of the emergence of inflorescence). The experiment was repeated *in situ* for three consecutive seasons with the identical design of Rendomised Block with six replications.

Highest yields of both grain and straw have been obtained with the application of both Organic and Inorganic manure during weeding (*i.e.,* about one month after transplanting) and they are significantly superior to the yields obtained by the applications during puddling and during Thormuck stage, which evidently indicates that the best time of application of both Organic and Inorganic manure is during weeding. With regard to grain yield the application of manure during puddling is significantly superior to the application of manure during Thormuck stage, whereas with regard to straw yield there is no significant difference between the said two treatments.

With regard to the quality there is no significant differenece in grain and straw yields between Organic and Inorganic manure.

74. A Note on the Grain Standardisation in Rice.

A. K. Kar, Bankura.

With a view to receive the nature of the rice grain of Rupsal type in the early, medium and late strains of transplanted Aus and Aman paddy crop suitable for Danga, Bad, Kanali and Shole lands characteristic of lateritic tract, selected strains of Ashkata (early Aus), Khiramungi (early Aman) Nonaramsal (medium Aman), Bhasamanik and Raghusal (Late Aman) were crossed with Rupsal at the Rice Research Station, Bankura. Rupsal is a transplanted Aman Paddy strain of fairly high yielding quality with fine white translucent grain of very high milling and cooking quality suitable for export trade. Hybrid crosses were studied upto F9 and the desired characters were established through subsequent selection and field trials. Almost all the hybrid strains are breeding true. Out of the hybrid crosses which are breeding true some of the strains of Ashkata X Rupsal, Khiramungi X Rupsal, Nonaramsal X Rupsal, Bhasamanik X Rupsal and Raghusal X Rupsal have already given promising yield with the standard Rupsal type of grain under field trials and the rest are still in the experimental stage.

75. Analytical Studies on the Plankton Periodicity of the Calcutta Water Supply Settling Tank.

HIMANSU KUMAR ROY, Calcutta.

This study was intended for finding out the probable chemical and physical factors responsible for the rapid growth and multiplication of the microphytoplankton flora, especially the diatoms, of the settling tank during some specific periods of the year. The highest yield of the settling tank plankton, mainly of diatoms, unlike that of the river water ones, is recorded during the maximum temperature period of summer, but at the same time, the same diatom genera have been found to occur in the settling tank with almost equal dominancy during both the high and low temperature periods. Also, there seems to be no significant correlationship between the plankton yield and the free ammonia, nitrite and nitrate content of the water which is found to be very low in these contents but for some special occasions. A record of comparatively lower content of these compounds in the settled than in the river water, however, goes to suggest that some amount of the simple nitrogenous compounds carried by the river to the settled water are used up by the phytoplankton of the settling tank. The association of a relatively higher rise of the nitrate content of the settled watter with a comparatively greater pulse amplitude of diatoms of the spring-summer months of 1946 and 1948, on the other hand, tends to point towards the nitrate content playing an important role in the determination of diatom periodicity. But the preceding and succeeding summer pulses do not seem to have much support for this interpretation. Assuming that this may be due to some other factors playing as a limiting one, a reference is made to the past records of silica content figures for comparison, as these were not collected during the three years of study, when actually a positive correlationship is obtained between the silica content and diatom periodicity. The extreme fluctuations in the absolute values of the silica content during the same season of two different years also suggests that this may be a reason of the relative differences in the intensities of the seasonal yields of diatoms of the different years; and it may be due to the combined effect of the increased nitrate content with silica, calcium and magnesium that there is a greater intensity of diatom yield of the settling tank during the spring-summer months when the silica content is comparatively lower than that of the winter months.

The record of the lowest albuminoid ammonia content during the months of september to november, when the Myxophyceae indicates a pulse on the periodicity curve inspite of the hardness and alkalinity due to bicarbonates of the water already going down, suggests that the blue green algae probably draws direct nutrition from the soluble organic matter set free by the decaying diatom cells during thit period.

Cytology and Genetics

76. Cytological Studies in Hydrocharitaceæ.

Y. SUNDAR RAO, Hoshiarpur.

A cytological study of Hydrocharitaceae has revealed the following diploid chromosome numbers: *Blyxa* spp., 2*n*-16; *Hylrilla verticillata* Casp., 2*n*-16; *Vallisneria spiralis* Linn., 2*n*-20; *Ottelia alismoides* Pers., 2*n*-22 and 66; and *Boottia* spp., 2*n*-66.

In *Vallisneria spiralis,* the somatic chromosomes show distinct size variations and the chromosomes of the two sexes do not differ either in morphology or number. There are three pairs of long chromosomes with terminal constrictions, one pair of medium sized chromosomes, also with terminal constrictions and six short pairs with subterminal constrictions. One pair of chromosomes is nucleolar and though *Vallisneria* is a diploid on this basis, the ten bivalents at I metaphase show secondary association forming 3(2) + 4(1). If secondary association is a reliable guide to polyploidy, it probably had originated from a seven chormosomal ancestor. This is in accordance with the fact that the lowest haploid number reported so far in the family is seven and that *Lagarosiphon,* a close relative of *Vallisneria,* is characterised by it.

Blyxa spp., resembles *Vallisneria* in its vegetative characters but the floral construction is very different and so are the chromosomes. The sixteen chromosomes vary but little in size and possess terminal or subterminal constrictions. Like *Vallisneria,* however, there are two nucleolar chromosomes and there is no sex chromosome mechanism.

In *Hydrilla verticillata,* the karyotype consists of five long and three short chromosome pairs with median, sub-median and sub-terminal constrictions.

Ottelia alismoides has been found to be an extremely polymorphic species with diploid and hexaploid races having twenty-two and sixty-six somatic chromosomes respectively. Janaki Ammal reported a race with $2n$-ca 40 and is probably a tetraploid. The idiogram of the diploid race consists of one exceptionally long chromosome with almost a median constriction, seven chromosomes of variable lengths with median, submedian and sub-terminal constrictions and three short chromosomes with sub-terminal constrictions. In the diploid complement two chromosomes are satellited and correspondingly there are two nucleoli in the telophases.

Morphologically the polyploids are in distinguishable from the diploids but differ in geographic distribution. Plants collected from the Godavari district of the Andhradesa are diploid and those of the upper Gangetic plain are hexaploid. Again *Ottelia alismoides* in Bangalore is also polyploid as shown by the work of Murty. It looks as though that the diploids have a restricted range of distribution when compared with the polyploids.

The species of *Bootia* resembles *Ottelia* cytologically in having sixty-six somatic chromosomes in the root-tip cells. This provides a cytological confirmation for merging this genus in *Ottelia,* as advocated by Dandy.

In general it may be concluded with certain reservations that the karyotypes in Hydrocharitaceae have long median and short chromosomes, a feature found in many Helobiales and the intergeneric relationships can be explained on the basis of aneuploidy, genic and structural changes. Polyploidy has played but little part in speciation. It has been mostly helpful in extending the range of distribution of species as shown by the distribution of the inter-specific polyploids of *Ottelia alismodes.* The significance of polyploidy in the evolution of Hydrocharitaceae, particularly in *Ottelia,* requires investigation.

77. Somatic Chromosome numbers of some Wild and Cultivated Varieties of *Musa.*

S. Govindaswami, Poona.

A collection has been made of 18 wild and cultivated varieties of the genus *Musa* from different parts of India. Somatic chromosome numbers of the following have been determined:—

Sub-genus *Rhodochlamys* (1) *Musa rosacea,* $2n = 22$ & $21+1$ f. (2) *Musa rubra.* $2n =$ (3) *Musa dasycarpa,* $2n = 22$. (4) *Musa sanquinea,* $2n = 22$.

Sub-genus *Eumusa* (1) Ramkela, $2n = 22$. (2) *Musa textilis,* $2n = 22$. (3) Elvazhi, $2n = 22$. (4) Ennabenian, $2n = 33$. (5) Anai Komban, $2n = 33$. (6) Kallumonthan, $2n = 33$ and $33+1$ f. (7) Poovan, $2n = 33$. (8) Muskel, $2n = 33$. (9) Mutheli, $2n = 33$. (10) Lal Kel, $2n = 33$. (11) Lal Velchi, $2n = 33$. (12) Rajeli, $2n = 33$. (13) Basarai, $2n = 33$. (14) Safet Velchi, $2n = 22$ and $22+1$ f.

The varieties belonging to the sub-genus Rhodochlamys have $2n = 22$ & $2n = 22 + 1$ f. chromosomes, whereas the members belonging to this sub-genus Eumusa show two distinct lines of chromosome numbers namely $2n=22$ or $22+1$ f. and $2n=33$ or $33+1$ f. The seedless nature of the edible bananas is usually attributed to their tiploid chromosome constitution. In the present investigation it is observed that the varieties Ennabenian, Kallumonthan, Anaikomban and Poovan are really triploids although they are stated to be seeded. Similarly the variety Safet Velchi considered to be a good table variety has $2n=22$ chromosomes. This is being further investigated.

78. A Further Evidence on the Sex Chromosomes in Coccinia Indica.

L. S. S. KUMAR, G. B. DEODIKAR, S. VISHVESHWARA, Poona.

The authors in their previous communication had reported the *xx* condition of male and *xy* of female in *Coccinia indica* and the nucleolar origin of the sex chromosomes. The present paper furnishes further evidence in support of the *xx* condition of the male supported by photomicrographs which provide incontrovertible evidence for the (1) nucleolar origin of the sex chromosomes in the male and (2) their complete morphological identity in respect of size and shape (*xx*).

During anaphase I, the *xx* pair shows precocious anaphasic separation associated with the formation of chromatin bridge due to the long persistent chiasma in the terminal regions of the short arm. The chromatin material for such a bridge may be contributed either equally by both the members or one of the members only. In the former case the two separating masses look equal in size but in the latter case they look unequal since the member which contributes to the formation of chromatin bridge looks smaller than the one which does not so contribute. Such gross superficial appearance has led some authors (Bhaduri, 1947) to wrong inferences regarding the heteromorphic condition of the male in *C. indica.*

79. Colchicine Induced Polyploids in Linseed.

HARI KISHORE and N. PARTHASARATHY, New Delhi.

Work in progress at the Indian Agricultural Research Institute, New Delhi on induced polyploidy as a method of crop improvement has indicated that the initial materials must be as varied as possible for treatment. The autotetraploids generally have varying degrees of sterility and it has been found possible to obtain more fertile plants by selection in hybrid progenies.

In view of the above, work on linseed was started in 1948-49 by taking up six high yielding rust resistant strains evolved at the Indian Agricultural Research Institute for treatment with colchicine. The application of this chemical in aqueous solution to the young growing tips above the cotyledon gave the best results.

The tetraploids obtained showed comparatively gigas characters in stomata, pollen, anthers, capsules and seeds. There was variation in seed setting from 1 to 7 seeds per capsule while the average for diploids was seven. Selections were made among the tetraploids of different strains for high seed setting. The problem of sterility may not be a serious factor in this crop. However, breeding behaviour of these tetraploids in respect of chromosome number remains to be investigated. The study of meiosis in pollen mother cells revealed that at metaphase I, 4 to 14 quadrivalents are formed, but the disjunction of the chromosomes was observed to be normal.

80. Studies on the Cytogenetics of Mango.

BASUDEV ROY, Poona.

From cytological studies of 15 varieties and seedlings of the cultivated mango namely (1) Alphonso (2) Amini (3) China No 1. (4) Gadhmar (5) Kalkhand (6) Lal Pairi

(8|19 G. B. G.) (7) Malgoba (8) Pairi (9) Romani (10) Roos (11) Shendraya. (12) Seedling No. S. N.|1 (13) Seedling J. M.|1 (14) Pai Posha and (15) a local variety collected by Prof. S. P. Agharkar from Narayangaon, Poona District, it has been observed that all of them except the Seedling No. S. N.|1 possess $n = 20$ or $2n = 40$ chromosomes. The seedling No. S. N.|1 has got $n=21$ chromosomes which seems to be an aneuploid form.

Midnight fixation of root tips showed greater frequency of cell division than that in day-time.

Mango varieties may be classified into groups on the basis of such characters as (*i*) presence or absence of beak, (*ii*) presence or absence of the ventral cavity, and (*iii*) presence or absence of the shoulder etc.

Occurrence of mericlinal chimaera has been observed in some grafted mango trees of Alphonso and Portia varieties.

81. A Preliminary Note on the Cytogenetic Survey of the Genus *Commelina* In India.

G. B. Deodikar, Poona.

Over 25 species together with a large number of ecotypes collected from various parts of India, Burma and Ceylon, their intraspecific and intervarietal polyploids and a natural interspecific hybrid, have been included in the present investigations.

Observations have been recorded on (1) chromosome size and morphology, (2) analysis of meiotic conjugation, (3) nucleolar chromosomes, (4) secondary associations, (5) distribution, (6) structural changes in chromosomes, (7) morphological differences, (8) taxonomic affinities, and (9) geographical distribution.

Evidence from all these relevant lines, leads to the conclusion that there are two polyploid series in primary and secondary chromosomal balance with 8 and 16 as their respective monoploid numbers.

All species are characterised by a range of variation in their chromosome number, which increases with the increasing polyploidy. *C. nudiflora* shows intraspecific autopolyploid series ($n = 8$, primary) and *C. obliqua* shows intervarietal polyploid series $n = 16$, secondary) up to Octapliod.

Species in primary chromosomal balance show maximum distribution with high diversity in Ceylon and Peninsular India. Species in secondary chromosomal balance increase in the northern direction. Central India and the Deccan Traps show a mixed distribution.

82. The Riboflavin Excreting Mutant and the Problem of Variability in Yeasts.

B. Ranganathan and M. K. Subramaniam, Bangalore.

Artificially produced top yeasts appear to be autotrophic and aerobic and excrete into the wash considerable amounts of riboflavin. The possibility that these may be highly useful for Compressed Yeast Manufacture necessitated a consideration of the problem of stability in yeasts.

Investigators subscribe to the belief that yeasts are unstable. The problem of stability has received only scant attention and no previous attempt has been made to discover methods to induce stability. Literal acceptance of the above view would not only invalidate the classification of yeasts into species and genera, but would also leave unexplained why the strains used in industry are highly stable.

Systematic observations of the changes in the sculpturing of the giant colonies of the top yeasts extending over two years indicate only a waxing and waning of the size of the rough rim during different seasons when cultured at the room temperature.

This waxing and waning of the sculptured rim parallels the predominance of the rough and smooth types of colonies in the control, which have already been interpreted as the result of mutations to different alleles at the locus determining the nature of sculpturing. Since the top yeasts appear to be the result of a chromosomal translocation, the genic sequences should have been altered and as a result the mutations at the loci governing the nature of sculpturing should produce phenotypic expressions entirely different from that observed in the control. Tetraploids are highly stable and industrial types should be polyploids.

Induction of polyploidy is a possibility and hence the question of stability ceases automatically to be a nightmare to the practical breeder.

83. Alleles and their time of Expression in Yeasts.

M. K. Subramaniam, Bangalore.

The various types of sculpturing observed in giant colonies of the two-chromosome brewery yeast could be classified into distinct types in an ascending grade of complexity. This classification is shown to be a natural one on the basis of observations on types exhibiting finally a complex sculpturing.

The simpler types appear as orderly stages during development of the complex ones. Photographs illustrating such stages are given from two strains isolated after ultra violet irradiation and having different early histories.

The same types could be recovered year after year and the failure of the early workers in this direction may be due to a lack of realisation of the effect of the environment on genic expression in giant colonies.

The multiple alleles occurring at the locus governing the nature of sculpturing appear to be related to one another as hypo-and hypermorphs. It is indicated diagrammatically how with increasing complexity of final expression, the earlier types are not only pushed farther and farther back, but that there is also a corresponding shortening of the time of duration of each stage.

84. Effect of Chromosomal Duplication on the Alcohol Tolerance of a Brewery Yeast.

S. Duraiswami, Bangalore.

The question whether duplication of chromosomes alters the alcohol tolerance was investigated in view of the fact that such a duplication resulted only in a quickening in the rate of fermentation and not in the quantity of the final product.

Alcohol tolerance has to be redefined as that concentration of alcohol by weight above which the percentage of sugar utilised falls below 90%.

Cells grown under various environmental conditions showed differences in their alcohol tolerance. The remarkable fact, however, was that under all the conditions studied the tetraploid had a higher alcohol tolerance than the diploid.

85. Fermentative Ability of the Riboflavin Excreting Mutant Yeast.

K. K. Mitra, Bangalore.

A recent observation showed that the top yeast mutant obtained by the treatment of a brewery bottom yeast with acenaphthene for 90 days is endowed with the property of excreting a large amount of riboflavin into the culture medium. Since riboflavin is known to play an important role in the form of the flavo-proteins in the respiratory and fermentative processes, it was thought interesting to investigate the fermentative characteristics of the control and the mutant strains on a comparative basis. It was found that the mutant, unlike the control, is unable to ferment glucose, fructose, galactose, maltose and sucrose. It has been suggested that this loss in the fermentative power in the case of the mutant may be correlated with its property of excreting the synthesised riboflavin. It appears as though as a result of a chromosomal translocation the strain has lost the capacity to bind up the riboflavin in the form of the enzyme systems responsible for fermentation.

Paleobotany

86. Fossil Microflora from the Mohgaon-Kalan Beds on the Central Provinces.

S. D. CHITALEY, Nagpur.

This paper deals with the fossil microflora from the Tertiary beds of the Central Provinces, exposed near a village, Mohgaon-Kalan in the Chhindwara district.

For the maceration of the cherts, Schulkze's maceration fluid (HNO_3 & $KCLO_3$) was first tried, but found to be fruitless. Later on, the other method of the HF treatment was used, which proved to be quite successful in crumbling the rock.

Description of twenty five different kinds of spores and pollen grains is given in the first part. Out of these a few belong to Pteridophytes or Gymnosperms and the rest to Angiosperms.

In the next part, the following organic remains are recorded:—

> Two types of vascular elements, one with bordered pits on the wall and another with spiral thickening; an unicellular hair with a pointed knob at the end; a piece of leaf cuticle with short, sinuous walled cells; another piece of cuticle probably of Gramineae, with sinuous walled, alongated cells and dumbel shaped stomata and a few epidermal outgrowths of unicellular pointed hairs.

As the pollen grains showing closest resemblance to those of Lythraceae, Myrtaceae, Palmaceae, Rosaceae, etc., are identified in the above study, it is suggested that the microflora from these beds may in all probability give a corroborating proof to the late Prof. Sahni's view, saying that they are Eocene.

The microflora from this bed is described here for the first time in detail except when recorded by me in the "Palaeobotany in India", Nos. 6 (1947) & 7, (1949). *in press.*

87. Plant Impressions from the Coal Measures of Southern Shan States (Burma.)

B. S. TRIVEDI, Lucknow.

In this paper are described only a few well preserved plant remains from amongst a large number of impressions which were examined. *Scleroptaris furcata* Halle, *Sphenopteris rotundiloba* Saporta, have well preserved impressions. They have been reported for the first time from this area. Three imperfectly preserved species of *Sphenopteris* and three species of *Zamites* besides a number of other unrecognizable plant remains have been described.

The rocks have been metamorphosed so that many of the impressions have been obliterated. This change has affected the microfossils as well, with the result that neither a cuticle nor a single spore could be recovered. On microscopic examination only small, structureless, carbonised pieces are visible.

The palaeobotanical evidence tends to support a mid-Jurassic age for the coal measures as was proposed earlier by Cotter in 1922.

88. Search for Microfossils in the Purple Sandstone, Salt Range, Punjab.

A. K. GHOSH AND A. BOSE, Calcutta.

Hsü (*Proc. Nat. Acad. Cc.* B, *16,* 92, 1946) failed to recover any microfossils from these beds from a few samples examined by him. Sahni (*loc. cit*), remarked "It must of course, be admitted that this negative evidence from a few samples does not necessarily mean that the rocks are unfossiliferous, or indicate beyond doubt that they are of very ancient dates".

An examination of a sample (G.S.I. No. 5226) from North of Chenki, Jabbi, Salt Range, yielded a few microfossils and reported earlier (*Proc.* 35*th Ind. Sc. Congress,* part 3, *Geo.* & *Geog. sec.* 1948).

Further examination of samples from Warcha gorge on the eastern slope north of Salt Chauki, yield carbonised and non-carbonised pieces of wood showing uni-multiseriate pits, scalariform and bordered pitted tracheids; cuticles with or without stomata; a few spores; insect remains and other unidentifiable vegetable matters. The total number of microfragments recovered from surface samples are 171 and that from samples 1 ft. inside are 109.

The occurrence of such characteristic and well formed parts of terrestrial flora in the 'Cambrian' age and its bearing on the age of the underlying Saline Series and phylogeny of vascular plants are discussed.*

*This work is being carried out with the aid of a grant received from the Burmah oil company (India Concessions) Ltd.

SECTION OF AGRICULTURAL SCIENCES

President: R. L. Sethi, I.A.S.

1. Rainfall in Relation to Agriculture and Population in Yeatmal District.

BHALCHANDRA K. BIDVAI, Amaraoti.

The paper attempts to correlate certain Physical and Human facts in the Yeatmal District of Berar.

The annual rainfall in the District is about 38 inches of which the summer monsoon contributes 87 p.c. The rest of the year is mostly dry. Agricultural activities are well adjusted with the normal distribution of rainfall on which also depends the prosperity of the people. But there is often a great variation. A comparative study of typical years reveals that a wide departure from the normal appears to be not beneficial to agriculture. The failure of rains in September and October is especially harmful. That is why 1906 and 1907 were years of Scarcity and 1896, 1899, 1918 and 1920 of famine.

Malaria is most prevalent when rain fails is September and October but for which the District is quite healthy. The best decade from the point of view of health was 1901-1910 and the worst 1891-1900.

The paper concludes that the distribution of rainfall is of greater significance than the amount and the failure of rains in September and October adversely affects agriculture and the health of the people in the District of Yeatmal.

2. Refrigeration Experiments on *Trichogramma Evanescens Minutum* Riley, an Egg Parasite of the Sugarcane Stem and Root Borers.

T. V. VENKATRAMAN AND M. L. GOVIL, New Delhi.

The effect of refrigeration on the viability, longevity, fecundity and sex ratio of the well-known egg parasite, *Trichogramma evanescens minutum*, was undertaken to find out if the eggs of the host (*Corcyra cephalonica*) *parasitised* by *Trichogramma*, cannot be successfully held in the Frigidaire at a temperature of 10° to 12° C for any great length of time.

Viability experiments to determine the percentage surviving showed that (*i*) the average percentage of viability decreased gradually as the period of refrigeration was increased, and (*ii*) up to 15 days, refrigeration, the viability was not adversely affected.

Refrigeration of the parasitised eggs affected the longevity of adults, depending on the period of cold storage. Results of a comparison of longevity of adults mating and laying eggs, and non-mating and not laying eggs showed that (*i*) there was practically no difference in the longevity in both cases up to 15 days, and (*ii*) the longevity in both cases was not affected adversely up to about 15 days of refrigeration.

Experiments of the fecundity of the parasite have shown that the number of eggs laid by a female decreased as the period of refrigeration was increased. It has been shown that the parasitised eggs, 4 days after parasitisation, could be successfully stored for a period of 15 days, at a low temperature of 10°—12° C, without impairing the fecundity to an appreciable extent.

The effect of refrigeration of parasitised eggs on the sex ratio was not in evidence up to about 10 days of refrigeration, Beyond this period there was a gradual increase in the percentage of females, the average percentage being 61.2 after 25 days of refrigeration.

The results have clearly shown that parasitised *Corcyra* eggs, four days after parasitisation, can withstand successfully a period of 15 days refrigeration (temperature 10°-12 C: Relative Humidity, 70-90%) without appreciably affecting the viability, longevity, fecundity and sex ratio. The practical importance of these findings need hardly be emphasised.

3. Isolation and Purification of Datura "Distortion" Mosaic Virus.

S. P. Capoor, Poona.

A virus disease of *Datura albe* Nees. was discovered in 1939 and designated as "distortion mosaic" of *Datura alba* in 1948 (Curr. Sci. *17*: 151).

The virus, though thermolabile (inactivated at 60° C. in 10 minutes), sensitive to ageing (longevity *in vitro* 13 days) and not present in high concentrations in the host plant (dilution end point 1×10^{-4} withstands treatment with 95% ethyl alchohol for over 30 hours at low temperature.

For virus purification, juice from leaves of diseased *D. alba* plants was extracted by grinding the leaves fresh in a laboratory mill and the pulp strained through cloth. A second extraction was made with some crystals of K_2HPO_4 and distilled water. The two extracts were mixed together and to it enough 95% ethyl alcohol was added to make a 50% alcoholic solution. On standing at 40°F., the coloured precipitate which formed was removed by centrifuging. Three-fourths by volume of 95% alcohol was then added to the clear supernatant fluid. This precipitated all the virus, which was spun down within 20 minutes at 3,500 r.p.m. The precipitate was then taken up in distilled water equal to one fifth the volume of original sap, and its H-ion concentration adjusted to pH7 by dilute NaOH. Further purification was done by acid and ammonium sulphate. All purification procedures were carried out at about 45°F.

The purified virus solution was opalescent and highly birefringent when shaken between crossed polaroid plates and showed anisotropy of flow visible to the naked eye. The virus, which is isoelectric at pH 4.5, forms long rod-shaped paracrystals at pH 5.5 and aggregates into small spindles on further concentration. True crystals are, however, not formed and it remains in a liquid crystalline state. The purified preparation was mostly free of any pigmentation as confirmed by the visible spectrum photograph. It also gave biuret, Mollisch's and Millon's reactions. Work on other properties of the virus protein is in progress.

4. *Xanthomonas Badri* in Nov. Sp. on *Xanthium strumarium* L. in India.

M. K. Patel, Y. S. Kulkarni and G. W. Dhande, Poona.

A bacterial leaf-spot on *Xanthium strumarium,* a weed commonly found in low lying areas all over India, was noticed near Government Farm, Jalgaon, in August 1948. Search through literature revealed no mention of any bacterial disease on this host and since it differs from the bacterial pathogenes so far known, it is considered to be new to science.

The pathogen enters the leaf through hydathodes and produces irregular, pale yellow, spots on the leaf-borders. The spots gradually increase in size when the central portion of spots becomes deep-brown accompanied by a yellow border. In severe cases of attack, the entire leaf-border gets infected and the leaf shrivels. Under ideal conditions of humidity and temperature, the infection becomes systemic as the organism migrates to the leaf-veins and makes its way as far as the steam through the leaf-petioles. Wilting of young plants from top downward is not uncommon.

Description of the Organism: Short rod, single or in chains, gram-negative, not acid fast, non-spore former, motile by a polar flagellum and measures 1.59 μ x 0.83 μ

On potato dextrose agar plates, colonies round, smooth, glistening, capitate with entire margins, 0.8 to 1.0 cm. in diameter after 4 days, colour empire yellow; on nutrient agar plates, colonies smooth, glistening with entire margins, 7 mm. in 4 days, the inner 6 mm of the colony pale yellow while the outer 1 mm. border of the colony empire yellow; gelatin liquefied; casein digested; starch attacked; litmas reduced in 8 days; acid but no gas in dextrose, lactose, mannitol, salicin and sucrose; M.R.V.P. tests negative; nitrites and indol not produced; ammonia produced; Loeffler's blood serum slowly liquefied; thermal death point about 51°C.

Pathogenic to *Xanthium strumarium and peas* (*Pisum sativum* L.) only.

5. The Inheritance of 'Dwarf' Mutants in *G. Arboreum* race *Indicum.*

R. Balasubrahmanyan and Santhanam, Madras.

The genetics of four dwarfs recorded in G. *arboreum race indicum* is summarised in this note. They are (a) Coimbatore dwarf (b) Coconada dwarf (d) Anakapalle dwarf and (d) '1767' dwarf. All the types were characterised by short internodes and the last three by a lower number of nodes than the normal, the cumulative effect of both being dwarfing. Coimbatore dwarf behaves as a monogenic recessive to normal in both *arboreum* and *herbaceum crosses*. 'Anakapalle dwarf' is a simple recessive to normal while it behaves as complementary to Coconada dwarf. Lint colour and plant habit are inherited independant of one another. The F2 distribution of the cross '1767' dwarf x Coconada dwarf is observed to present a unimodal curve with no segregation and with its mean about that of the parents. They represent possibly independant mutations at the same locus, but carrying different complex of modifiers and provide an interesting instance where two degenerative recessives when intercrossed manifest heterosis. The gene symbols *db*, *dc*, and *dd* are given to Coimbatore dwarf, Coconada dwarf and Anakapalle dwarf respectively as per accepted convention (Hutchinson and Silow, 1939) while Venkoba Rao and Ramachandran's (1943) *herbaceum* mutant may be designated *da*.

6. The Inheritance of Lint Colour in Coconadas Cotton.

R. Balasubrahmanyan, V. Ramaswamy Mudaliyar and
V. Santanam, Madras.

The task of evolving a suitable strain for the Coconada area, combining both length and colour, led to the study of extensive crosses to break up short staple—colour association. The relevent aspects of this study pertaining to inheritance of lint colour and its relation in metric length in seven crosses involving white and coloured pure lines of the area is summarised in this note. The white linted Coconada pure line of the area is 45 is a simple recessive to Khaki A9 (LcK1). Strain Coconadas 1 carries the very light brown gene LcV2, while the behaviour of the deeper coloured pure lines

'123' and '129' suggests their probable genotype as LcB2. Nanking Khaki behaves as a smile dominant over Coconadas 1 (LcV2) indicating that it carries a darker allele at the same locus and the parental and F1 grading admit of an LcK2 postulate. G 1037 and G 1019 exhibit a bifactorial difference with Coconadas 1, confirming their genotype as LcK1. The affect of environment on the colour expression and fadding is stressed. A study of the association between length and colour reveals a uniform reduction in the length of brown segregates in all the hybrid progenies. The importance of the genic status of the Coconada area is indicated.

7. Systematics of a New Species of Aphis from Poona (Aphididae).

H. L. Kulkarny, Poona.

During May 1949, young shoots of *Phyllanthus emblica* were noticed badly damaged by aphids.

This aphid has revealed following interesting features:

(1) In the alate viviparous females the cubital vein in the fore-wing is only once branched as in genus *Toxoptera.* However, the second pair of wings are totally reduced into elongated structures. Secondly, the veins are smokey as in the genus *Pentalonia.*

(2) The cornicles and cauda are very characteristic. Cornicles are truncated as in genus *Therioaphis,* but the cauda is not knobbed nor is the anal-plate bilobed. Besides, the body of both the alate and apterous forms does not bear capitate hairs but on the contrary smooth as in genus *Aphis.*

(3) Antennae are only 5 segmented, the flagellum of the termin segment being very short.

(4) The head is as in genus *Aphis.*

This aphid has not been previously recorded in this country. The author thinks that it can very well be classed separately on account of the characteristic features not recorded so far, by previous workers.

8. Effect of Buttress Grafting on Growth and Development of Orchard Trees.

S. R. Gandhi, Poona.

The rejuvenation of the tops of ancient historic trees by buttressing their decaying trunks by inarching young seedling rootstocks of the same family is a well-known horticultural practice employed in all civilised countries of the world. In Bombay Province, it is being employed on healthy mango trees as a regular orchard practice with the same object. Its application is however indiscriminate, the inarch being applied not only to the scion trunk of the tree but also to its stock part and individual branches.

The author's investigations indicate that the ultimate physiological effect of buttressing the scion trunk amounts to the gradual replacement of original roots of the tree with new ones. Buttressing the stock results in an additional competitive root system which does not contribute towards the better development of the scion top. Butteressing the individual branches of a tree means dividing its top in so many independent subtrees which behave differently from one another and the parent top, in growth and development. To rejuvenate a sickly orchard tree, the inarch or buttressing root-stock hsould be applied to its scion trunk. Buttressing a healthy orchard tree is a wasteful practice which does not at all invigorate its top.

9. A Study of the Digestibility of the Proteins of Gram Varieties.

V. S. ABHYANKAR, M. S. NAIK AND J. A. DAJI, Poona.

Two varieties of gram, *chafa* and early *gulab*, have been evolved as improved strains from the local one. *Chafa* is a high yielder while early *gulab* has better parching quality compared to the local gram. The present paper deals with the digestibility of their proteins when subjected to the action of pepsin and trypsin *in vitro*. It is found that *chafa* gram is superior to early *gulab* or local variety.

10. A note on the Experiments on manuring of Grass Land at Palghar Bombay Province.

G. K. ZENDE AND O. G. KUNDALKAR, Poona.

A manurial experiment involving two doses of Nitrogen (30 and 60lbs. of Nitrogen per acre) in the form of F. Y. M., Groundnut cake and mixture with Sulphate of Ammonia, alone and in combination with superphosphate supplying 40 lbs. P_2O_5 per acre, was carried out on grass land at Palghar from 1946 to 1948, with a view to study the effect of these manurial treatments on the yield and nutritive value of grass as grown in nature.

The analyses of the results have brought out the importance ofstudying, not only the response of the yield of a crop to a particular manure in the presence of other factors (manures) on the average, but also its study in the presence of each of the constitutents separately. Thus, in the present experiment, the average response of the yield of grass to superphosphate is 9 lbs., per lb. of P_2O_5 per acre in the absence of Nitrogen, while it is as high as 34 lbs. in the presence of Nitrogen. Furthermore, the response to superphosphate is different in the presence of different kinds of Nitrogen, being 44 lbs. in the presence of groundnut-cake, while it is as low as 14 lbs. in the presence of F. Y. M. The same tendency is exhibited in the case of mixture with Sulphate of Ammonia; the average response to superphosphate in the presence of Groundnut-cake + Sulphate of Ammonia and F. Y. M. + Sulphate of Ammonia, being 53 and 25 lbs. per lb. of P_2O_5 per acre respectively.

The addition of superphosphate has also improved the quality of grass, by increasing its lime content and phosphoric acid content and decreasing the ratio of the two factors.

11. Relative Utility of Different Phosphatic Fertilizers in Four Typical Soils.

D. L. SAHASRABUDHE AND V. K. LELEY, Poona.

The utility of (i) Rock phosphate (ii) tricalcium phosphate (iii) superphosphate (iv) ammonium phosphate (v) bone meal and (vi) groundnut cake is compared in four typical soils namely (i) lateratic soil from Belgaum (ii) black soil from Dharwar (iii) *goradu* soil from Nadiad and (iv) medium black soil from Poona. The fertilizers were added to the soils and the samples were kept in moist condition for four months. The phosphate supplying power and the total extractable phosphate were then determined, using a saturated solution of carbonic acid as an extractant. These results are used as a basis for the comparison.

It was found that the utility depends firstly on the nature of the soil and secondly on the nature of the fertilizer. Superphosphate gave highest results in all the four soils. Next in order followed calcium phosphate, ammonium phosphate, groundnut cake, bone meal and rock phosphate.

Soils from Dharwar, Nadiad and Poona retain a greater quantity of phosphates in a soluble condition than the lateritic soil from Belgaum. Superphosphate appeared to the better suited to the last soil.

12. Studies on the Storage of Mosambi Fruits Wrapped in 'Pliofilm'.

S. R. GANDHI, J. A. DAJI AND V. K. LELEY, Poona.

Pliofilm is a transparent packing material, prepared essentially from rubber hydrochloride. It is almost completely impermeable to Water vapour but allows a free diffusion of other gases like carbon dioxide, oxygen etc. It is ideally suited for wrapping fruits, vegetable etc. The work reported below is undertaken to give a trial to the material under the tropical conditions prevalent locally. *Mosambi* fruits (Citrus sinensis) were selected for study.

Fruits wrapped in pliofilm were kept at room temperature (80°F) and also in cold storage at 42°F alongwith fruits without wrappers to serve as control. External appearance, loss in weight of fruits, and chemical composition of the juice were recorded periodically for three months.

Fruits without wrapper lost marketable appearance within two weeks. They dried and became hard after six weeks.

Loss in weight during the period amounted to about 30 per cent. Fruits without wrappers keep better in cold storage. They were marketable for about two months. Total loss sustained by these fruits during three months amounted to about 24 per cent.

Wrapping in pliofilm considerably increased the storage life of the fruits both at room temperature and at 42°F. In either case the fruits were marketable even after three months. At room temperature they lost about 14 per cent of their weight during three months. The corresponding loss in the cold storage was only 15 per cent.

Chemical composition of the juice was not found to change appreciably in wrapped fruits as compared to the unwrapped.

13. Origin of Adventitious Roots in the Stem of Mulberry (*Morus indica.*)

D. B. SURTI, Poona.

The paper gives an account of the author's study in the origin of adventitious roots in the stem of Morus indica which when planted as a stem cutting gives rise to wound roots from the basal cut and also to morphological roots from definite points in the nodes of the stem. Miscroscopical examination of the nodal structure revealed that three distinct morphological roots emerged from leaf gaps caused in the vascular cylinder by the departure of three leaf traces which supplied the leaf.

These gaps bridge the cortex and pith by a parenchymatous tissue which becomes meristematic half way along the longitudinal extent of the gap and gives rise to morphological roots. The transverse section through the internodal regions, however, did not reveal any dormant root initials which would give rise to morphological roots. Wound roots given out from the basal cut bore no relationship with the anatomical structure of the stem. They arose endogenously after formation of new vascular tissue in the basal callus from a meristem which is a continuation of the cambium.

14. Effect of 24 Dichlorophenoxy Acetic Acid on Germination in *Sorghum vulgare*.

V. K. DESMUKH AND U. K. KANITKAR, Poona.

With the broader object of investigating the efect of plant growth substances on Indian Crops, preliminary experiments were performed with 2.4 Dichlorophenoxy acetic acid on *Sorghum vulgare*. The seeds were treated with the substance in watery solutions at various concentrations viz. 2ppm, 10 ppm, 100 ppm and 600 ppm. The time of treatment was varied from 5 minutes to 24 hours. The seeds after treatment were thoroughly washed with water and were then germinated on moist filter paper and in soil.

In Jowar No. 8, the strain used for this investigation, treatments with 100 ppm. for 5 minutes and 10 ppm for 2 hours accelerated the growth of seedlings in soil, as estimated at the end of 15 days. On moist filter paper 2 ppm, 10 ppm and 100 ppm for two hours showed a similar effect in ten days. In all cases treatment with 600 ppm. for any length of time was seen to retard the growth of seedlings. It could also be seen that the treated seeds show a lesser activity in initial stages of germination than the untreated in both cultures. They however, grew faster than the controls, equalising with them within 7 to 10 days, and surpassing them in 10 days in water and in 15 days in soil. It is considered that the treatment increases the rate of growth of the seedlings probably by affecting their internal metabolism.

14. Economics of Anaerobic Fermentation of Cattledung.

N. V. JOSHI, Poona.

Dual use of cattle-dung by fermenting it anaerobically for the simultaneous production of fuel gas and manure was suggested by me at the science congress in 1945. The construction of the plant designed for the purpose for the individual use of cultivators requires an initial outlay but no current expenditure for running it, as the work is carried on by the peaceful activities of micro-organisms. The estimated values of the two products from the installation of such plants, if used on a country-wide scale, as well as, on an individual basis are given in the form of tables. These tables bring out the difference in the value of products obtained according to the present and the proposed new method of ultilising cattledung for manure and fuel. This difference in value being known, we can easily judge and decide on the initial outlay required for installing such plants.

16. Preliminary Studies on the Comparative Trials to Test the Instanteneous Susceptibility of Alate and Apterous forms of Certain Common Insect Pests to Benzene Hexachloride as a Contact Poison.

G. M. TALGERI, Poona.

Though several workers all over the world have carried out experiments to determine the toxicity of benzene hexachloride against different species of insects, no effort seems to have been made to find out whether this insecticide affected the alate forms of certain insects more than the apterous forms. The present paper details the results of experiments conducted in the direction.

Tests were carried out with 5 per cent BHC (0.65% gamma isomer) against aphids (*Myzus* spp., *Rhophalosiphum* spp. and *Macrosiphum* spp.) particularly on peas and crucifiers, red ants (*Oecophylla smaragdina*) infesting mango and citrus trees, winged grass hoppers (*Hieroglyphus banian*) affecting the paddy crop and Deccan Wingless grasshopper (*Colemania sphenariodes*) on jowar crop. Besides in order to study the relative susceptibility of adult and immature stages of certain hemipterous insects with no apterous forms, mango jassids (*Idiocerus* sp.) and sugarcane leafhoppers (*Pyrilla* sp.) were tested with this insecticide. The insecticide was applied with rotary hand dust-gun at the rate of 25 lbs. per acre. The various tests were carried out by confining the infested plants or plant parts in wire gauge or cloth cages of different dimensions.

The relative susceptibility among different insects to 5 per cent BHC seem to vary considerably. Thus in vegetable aphids, about 80.1 per cent alate forms succumbed within an hour of treatment as against 19.2 per cent in apterous forms. In red ants (*Oecophylla smaragdina*), on an average 100 per cent susceptibility was noted in alate forms and only 32.2 per cent in apterous forms. Among the two species of grasshoppers however, the highest mortality of 94.5 per cent was observed in paddy winged grasshoppers (*Hieroglyphus banian*) and least in Deccan wingless grasshoppers (*Colemania sphenarioides*). In insects where there is no apterous stage as such, the susceptibility in adult stage (winged) was found 42.6 per cent and 56.5 per cent in mangohoppers (*Idiocerus* sp) and sugarcane leaf hopper (*Pyrilla* spp) respectively. The nymphal stage of these however was comparatively least affected.

Thus all these results show that the winged forms and species of certain insects are definitely more susceptible to 5 per cent benzene hexachloride than the wingless ones. However further observations in this direction are in progress.

17. Chemotropic Response of the Caterpillars of Amsacta Sp. to a Fermented Bait of *Thoria* (*Euphorbia nerifolia*) Leaces and *Mowhra* (*Bassia latifolia*) *Molasses.*

G. M. Talgeri, Poona.

The time-honoured methods of controlling the *Amsacts* sp. caterpillars, being not very satisfactory, the needfor evolving new methods was felt quite essential. The chemotropic response of these caterpillars to fermented food material was therefore taken advantage of and a new bait containing four parts by weight of *thoria* *(Euphorbia nerifelia)* leaves and one part of *mowhro (Bassia latifolia)* molasses, was devised.

The bait was broadcasted along the borders of infested *bajri* fields at the rate of 20 lbs. per acre and counts were taken every day of the total number of caterpillars feeding on the bait and plants as well, in six sampling units of each 10' x 10', selected at random per replication. It was observed that there was a progressive rise in the number of caterpillars attracted to the bait, as the bait fermented more and more. Simultaneously, there was a proportionate decrease in the number of caterpillars feeding on the plants. Thus at the end of one week, the average number of caterpillars feeding on bait in one unit area was 390.6 and only about 27.5 on the plants in that area.

The caterpillars feeding on the bait could be easily destroyed by passing a stone roller over the bait once in four or five days, when the maximum number was attracted. The cost of baiting in one acre of *bajri* or maize for a week was about Rs. 2-8-0.

This bait was much superior to the one previously tried by the author with the addition of sodium fluosilicate, which definitely rendered the bait less attractive and probably less palatable to the caterpillars.

However, further work to improve the efficacy of the bait, which opened a new line of research, is in progress.

18. Large Scale Operations against Plant Diseases in India.

B. B. Mundkur, New Delhi.

Large scale operations against plant diseases have recently been initiated in several provinces in India. In starting such operations, attention is at present given to food crops alone and to diseases which can be easily or quickly controlled by approved and scientific methods. Commercial and cash crops are at present not included in this programme, though such operations have been undertaken by the industry in the case of coffee, tea and arecanut diseases.

19. The Seasonal Variation in Nitrogen Contents of Goradu Soils of Gujarat.

C. C. SHAH, B. M. PATEL AND U. R. PATEL, Anand.

The goradu soils of Gujarat were examined for a period of one year for the content of total nitrogen, nitrate nitrogen and soil pH..The crop grown was Bajari and Nitrogen was applied to the soil at the rate of 0 lb., 20 lbs.,30 lbs., and 50 lbs. of nitrogen per acre.

It has been found that the total nitrogen is practically unaffected throughout the period of growth of the crop. But after the harvest of the crop, the total soil nitrogen increases throughout the winter period and comes to a low level in summer. The nitrate nitrogen is high during hot months but falls during the rainy season, and continues at the low level throughout the whole of the monsoon and the early part of the winter.

The pH of the soil which remained about 8 throughout the period increases a little during the month of September.

20. Calcium and Oxalic Acid Content of Vegetables of Gujarat.

C. C. SHAH AND S. Z. PATEL, Anand.

It is a well established fact that the presence of oxalic acid in a feed renders much of the calcium unassimilable. A number of vegetables are reported to be good sources of calcium, but in the absence of data regarding the oxalate content, this has little value in nutrition. For instance Fincke and Sherman found spinach useless as a source of calcium. Forty-five green foods including vegetables, leafy vegetables and tubers were analysed for the calcium and oxalate content. Of these five leafy vegetables and three tubers were found to have more oxalic acid than that necessary to combine with all the calcium. They are Amboi (Hibiscus sabdariffa), Luni; (Portulaca oleracea), Palak (Spinacca oleracea), Poi (Basella rubra), Onion leaves, (Allium cepa), Ginger, Turmeric, and Yam. Rich sources of available calcium are Curry leaves (Murraya Koenigii), Tandaljo (Amaranthus Gangeticus), Betel leaf (Piper betel), Cluster beans, (Cyaonoposis opsraliodes), Kankoda (Momordica Yoica) and Radish (Raphanus sativus) leaves.

21. Modification of Collin's Method for Determining Carbonate in Soils.

C. C. SHAH AND J. L. AMIN, Anand.

A rapid method for the estimation of carbonate in soils has been described. Use is made of a solution of Trichloracetic acid (150 gm. acid plus 10 gm. water) to liberate the carbon dioxide. The volume of Carbon dioxide evolved from pure calcium carbonate is measured. An amount of soil equal to 100 divided by the volume of carbondioxide evolved from 0.100 gm. Calcium carbonate is taken for liberating. carbondioxide. The volume of carbon dioxide then evolved divided by 10 gives directly the percentage of calcium carbonate in the soil. The apparatus used is also described and is simple to set up.

22. Colorimetric Determination of Soil Organic Matter.

C. C. SHAH AND B. V. MEHTA, Anand.

A rapid method for determining the organic matter in soils with the help of Klett's Colorimeter is described. A weighed quantity of the soil is allowed to react with definite quantities of normal dichromate and concentrated sulphuric acid. The dichromate is reduced and a green colour is developed. The intensity of the green colour is proportional to the organic matter in the soil. The resulting colour is a mixture of green and yellow. It is found that the measurement of the green colour using a red filter is speedy and fairly accurate. There is no interference due to the colour of soil inorganic matter. It is not necessary to calibrate the mesurements with a standard soil by the dry oxidation method. The calibration can be done by stoichemical calcultion. The method is found accurate for soils containing less than 4.5% organic matter. For soils containing more organic matter half a gram of soil is recommended for analysis.

23. Studies on the Fixation of Phosphates in Indian Red and Laterite Soils: III: Fixation Studies by Shaking Method: Influence of Factors Involved in Shaking.

M. K. MUKHERJEE, Calcutta.

(Laboratory Studies Section, Soil Conservation Department,) Damodar Valley Corporation.

When fixation of phosphates is studied by following the shaking method, the influence of the variable factors namely:—

(*i*) The Soil: Solution Ratio ;

(*ii*) The concentration of phosphate solution ;

(*iii*) The period of shaking ;

(*iv*) The manner of shaking ; has been studied.

All influence the fixation and for this it is desirable, for comparative purposes that all these factors should be made constant. It is desirable in case of red and laterite soils that a high amount of phosphate say 2,500 p.p.m or even higher concentration at a soil: Solution ratio of 1.20 for a period of 24 hours is suitable and the amount fixed under these conditions would fairly indicate the fixation capacity of such soils.

24. Soils of Damodar Valley: I: Soils of Barhi Area. A. Note on Preliminary Investigation Regarding Nutrient Status.

J. N. CHAKRABORTY, M. K. MUKHERJEE AND G. S. ROY, Calcutta.

In the Damodar Valley Project, the persons to be displaced for construction of Dams are to be rehabilitated. The soils of the area where displaced people are contemplated to be resettled are being surveyed to find out their suitability for agriculture. About 80 samples from Barhi Rehabilitation Area have been analysed for some plant nutrients. It has been found in majornty of soils that percentage Clay varies between 15-20%. These soils vary from slightly acidic to moderately acidic in reaction. Available P is very small, organic and difficultly available P are rather low and total Phosphorus is not inconsiderable. Exchangeable Ca is moderate and K is sufficient from the view point of plant nutrition.

25. Nitrogen Fixation and Seasonal Variation in the Nitrogen Content in Pusa Soil—under Cropped and Fallow Condition.

S. C. DATTA AND B. K. DAS GUPTA, New Delhi.

Nitrogen fixation and seasonal variation in the nitrogen content of Pusa Soil were studied for a period of about three years. Samples of both surface and sub soils from a plot measuring 1|24th acre were taken once in a month. One half of the plot was kept fallow and the other was sown with *Marawa* in *Kharif* and oats in *Rabi.* A portion of the sampled soil was kept at 30°C in an incubator at the optimum moisture content. Total nitrogen was determined after one month's and two months' incubation. It is found that nitrogen content of the soil reached its maximum twice in year once in August-September that is at the end of the rains and the other in March-April just at setting of he summer. The nitrogen content reached the minimum also twice a year, once during June-July when the rain fall was heavy and the other in December-January when the weather was very cold. It was also observed that the incubated samples of soil behaved in the similar manner as the field soil so far as the nitrogen content was concerned. The fallow plot always maintained higher nitrogen level than the cropped one ; but when the intake of nitrogen by crops was taken into consideration the level was found higher in the cropped plot.

26. 'Sterility' Disease of Pigeon Pea.

S. P. CAPOOR, Poona.

'Sterility' disease of pegeon pea (*Cajanus cajan Millsp.*) was reported from Bihar and simultaneously from Burma in 1931. It was brought to the notice of the writer in 1944, and became generally prevalent in the Bombay Province by 1946. A disease survey during that year revealed that 'sterility' was present in about 7 per cent of the crop. In January 1947, the disease had affected over 20 per cent of the plants grown for varietal selections at the Tobacco Breeding Station, Nadiad, North Gujrat. Investigations into the disease were immediately undertaken.

Diseased plants are characterised by a general palor, profuse and upright vegetative growth and absence of flowring branches. Leaves are generally smaller and pale green than normal, and often show a well marked mosaic pattern of pale green and light green areas. Malformation of leaf laminae does not occur.

'Sterility' disease was transmitted in 34 out of 75 plants grafted with diseased scion brought from Nadiad, while only in one of 22 plants inoculated by leaf rubbing in the glass-house at Poona. Grafted plants invariably showed mosaic symptoms in 35 to 40 days, but the plant infected by sap inoculation developed the disease after 81 days.

Symptoms of the disease, its behaviour under field conditions as well as in glass-house and the experimental evidence obtained are characteristic of a disease, and not consistent with a fungal or bacterial pathogen.

27. Relation of Food to ospore Production in *Phytophthora.*

M. K. DESAI, Surat.

The heterothallic strains (+ and − or Tyagli and Nilekani) of *Phytophthora arecae* Coleman, which supposedly lost the capacity to form oospores, could be restored to their original capacity of copious production of oospores by passing them through live host tissue, i.e., by feeding them on their natural host or by culturing them on French-bean agar. A subculture of *Phytophthora* isolated from jack-fruit could be similarly induced to form abundant oospores. A subculture of *P. meadii* received from Delhi which had lost its power of forming oospores started forming them sparingly when grown on French-bean agar. Thus, there is no evidence to suggest that the loss of fertility is due to deterioration of one or the other sex. Trials go to show conclusively that the loss in ability to form oospores during the process of subculturing by a species of *Phytophthora* appears to be due to lack of favourable nutrition which, if supplied restores the original capacity of forming ospores.

28. Breeding Rust Resistant Varieties of Wheat for Bombay Province.

V. P. GOKHALE, B. B. CHOWDHURY, M. K. PATEL AND V. M. CHAVAN, Poona.

Stem rust of wheat (*Puccinia graminis tritici*) is the most serious disease of wheat in the Bombay Province. Breeding rust-resistant wheats is the only feasible and economic method of combating the disease. Work in this direction has been in progress since the year 1923. Earlier attempts aimed at introducing the blood to Khapli, the variety which was popularly considered resistant, into the commercial varieties of the Province. Two strains, viz. Bansiplli-808 (Jaya), suited for dry cultivation and Niphad 4, suited for irrigated cultivation were evolved in this manner. Though both of them withstood rust better than other varieties, they were not resistant in the real sense of the term.

Work based on the knowledge of the physiologic races of rust was started in 1941 when facilities for testing wheat varieties and hybrids under controlled conditions became available at Mahabaleshwar under an I. C. A. R. Scheme. None of the indigenous wheat varieties and only a few of the large number of exotic varieties tested so far proved resistant to all the races of stem rust known to occur in Peninsular India. The exotic rust-resistant varieties, being agronomically unsuitable for this province, were crossed with two improved wheat strains. Homozygous rust-resistant segregates possessing desirable agronomic characters have now been obtained from the following crosses:—(1) Kenya E. 144 X Niphad 4. (2) Hofed 1 x Niphad 4. (3) Mondhya 417-5 x Hofed 1.

These segregates are *vulgares*. The absence of a rust resistant *durum* wheat proved so far a serious handicap in breeding rust-resistant wheats to replace the highly susceptible *durum* varieties grown over a large area in this Province. Gaza, an exotic rust-resistant *durum* wheat is now available and has greatly simplified the task.

29. Control of Plant Diseases through Disease Resistance in Bombay.

M. K. PATEL AND M. N. KAMAT, Poona.

It has been argued in certain quarters that field resistance is a sufficiently satisfactory basis for the isolation of resistant types of crop plants. This is really erroneous since experience with Pusa 4 and 12 wheats with reference to rust and Pusa 80 *tur* and Jarila cotton with reference to wilt has clearly shown the futility of such an argument. It is, thus, obvious that in any breeding programme for disease-resistance, there is a great need for approved technique whereby reliable and comparable results may be obtained at different times. Such standard techniques have been developed by Plant Pathology Section of the Bombay Department of Agriculture, pioneers in such a type of work in India, with reference to Fusarium wilts of sann hemp, *tur*, cotton, gram, lang, etc. The technique consists in the main, of testing and isolating resistant strains under standard conditions of soil temperature and infectivity in pots in a glass house and subsequent growing and selfing of the promising survivals in a highly infected plot. The process is repeated until homozygosity for wilt-resistance is attained.

Testing of wheat strains for stem rust-resistance is also being carried out at Mahableshwar by technique similar to the one evolved in U. S. A.. Several hybrids obtained by crossing Niphad 4 and Mondhya with Kenya E 144 and Hofed have shown homozygosity for rust-resistance and other desirable agronomic characters under field tests.

A technique, very similar in nature to the ones described above is being developed for testing rice plants against blast disease caused by*Piricularia oryzae,* recently introduced into Bombay Province.

30. Bacterial Leaf-spot of Lucerne.

M. K. Patel, Y. S. Kulkarni and G. W. Dhande, Poona.

A bacterial leaf-spot often mistaken for *Pseudopeziza medicaginis* was noticed for the first time in India in a *lucerne* plot on the Agricultural College Farm, Poona, in 1948. The pathogen was Isolated and studied in detail.

On leaves, the pathogen produces small, round, water-soaked spots measuring initially 0.5 to 1 mm. Some of the spots as they grow larger (1.5 to 2mm.) become irregular in shape having pale yellow centre with brown margins, presenting an appearance of an insect attack. When few such spots coalesce towards the tip and border of leaves, there occurs local distortion. Undeveloped spots remain as dark-brown specks. The pathogen produces small, brown, vertical scars on the stem.

The description of the organism as determined by us is given below:—Short rods measuring 1.96 μ x 0.80 μ motile by a polar flagellum, gram-negative, not acid-fast, non spore-former, staining readily with common dyes.

On potate dextrose agar plates, colonies are circular, smooth, shining, pulvinate with entire margins; colour baryta yellow (Ridgway); consistency butyrous; gelatin liquefied; starch attacked; litimus reduced; casein digested; nitrates not reduced; M. M. V. P. tests negative; ammonia produced; produces acid but no gas from arabinose, dextrose, lactose, maltose, and salicin; Loeffler's blood serum not liquefied; no growth in Uschinsky's solution; thermal death-point about 51°C.

Pathogenic to *Medicago sativa, Melilotus indica, Trigonella foenum-graecum* and *Pisum sativum.*

The organism is identical in morphological, cultural, physiological and pathological characters with *Xanthomonas alfalfae* (Riker, Jones and Davis) Dowson on alfalfa (*Medicago sativa*) reported from the U.S.A. and must have been introduced on imported seed from abroad.

31. Bacterial Blight Cowpea.

M. K. Patel and N. D. Diwan, Poona.

A destructive bacterial blight of cowpea was first observed on the Agricultural College Farm, Poona, in May, 1945. The disease appears as light yellow, irregular to round spots, measuring 4-10 mm., with necrotic brown centres. These spots increase irregularly until the entire leaf is involved. The dark, yellow colour surrounding the central pale brown spot fades off at the periphery while the small veins within the spots become reddish-brown and shrivelled. This discolouration of the veins may extend beyond the margin of the spot. In some cases, infection follows the veins, and the area around the vein becomes yellow. Heavily infected leaves become straw-coloured and remain hanging but drop down at the slightest touch. In severe cases of blight, the leaves dry up without showing any spots. In nature, infection takes place through stomata. No infection occurs on petioles and stems except through wounds. On the pods, the infection occurs in the form of dark green, water-soaked spots, 1½ to 2 mm. in size and varying in shape and number. Infection does not seem to extend to the seeds.

The morphological, cultural, biochemical and pathological characteristics of this organism resemble those of *Xanthomonas vignicola* Burkholder except in few minor details. The pathogene infects *Vigna catjang, V. sinensis, V. sesquipedalis* and several varieties of *Phaseolus vulgaris.* This is considered to be another instance where the pathogene has been imported from abroad.

32. Bacterial Leaf-spot of Chillies.

M. K. Patel, Y. S. Eulkarni and G. W. Dhande, Poona.

A bacterial leaf spot of chillies (*Capsicum frutescens*) was noticed for the first time in India on chillie leaves on the Agricultural College Farm, Poona, in August 1948.

On leaves, the pathogen produces initially a number of small spots which as they develop, become round to irregularly round (1 mm.) with raised water-soaked borders on the lower surface and a pale white centre with a slight depression on the upper surface. Leaves appear curly when edges and veins are infected: A few spots coalesce to form irregular lesions. The raised water-soaked borders of old spots become brown on both the surfaces. Severely affected leaves become yellow and drop off prematurely. Infection of leaf-petiole is common. When the pathogen infects tender stems, it produces longitudinal light brown cracks measuring sometimes 4 cms. In severe cases, wilting of young plants occurs due to girdling of the stem by the organism. The first visible symptoms on the fruit is a raised water-soaked spot which becomes brown with a depression in the centre.

Xanthomonas vesicatorium (Doidge) Dowson Short rod, gram-negative, motile by a polar flagellum, not acid-fast and measures 1.7 μ x 0.9 μ.

On potato dextrose agar plates, colonies smooth, glistening, raised, diam. 1 to 1.2 cm. in 4 days, colour apricot yellow (Ridgway); On nutrient agar plates, colonies flat, smooth, glistening, round with fringed margins, diameter 1 cm. in 4 days, the inner 9 mm. of the colony lemon-chrome (Ridgway) while the outer 1 mm. periphery of the colony is pale white; slight clearing of milk in 4 days; litmus reduced; gelatin liquefied; starch attacked; produces acid but no gas from dextrose, lactose, sucrose and salicin; nitrates not reduced; ammonia produced; Loeffler's blood serium slowly liquefied; M. R. V. P. tests negative; thermal deathpoint abount 51°C.

The disease is seed-borne; pathogenic to *Capsicum frutescens* and unripe tomato fruits.

33. Control of Yellow-Vein Mosaic of Bhendi in Bombay Province.

P. M. Varma, S. P. Capoor and M. K. Patel, Poona.

Bhendi (*Hibiscus esculentus,* L.) is a very important vegetable crop and is grown all over the Bombay Province throughout the year. During summer (March to June, however, it is cultivated only where fecilities for irrigation are availble.

The bhendi crop is seriously affected by a virus disease designated as *Yellow-Vein mosaic* on account of the characteristic yellow vein symptoms produced on the leaves.

As a result of infection, both the quality and quantity of fruits are considerably reduced. The virus is neither sap transmissible, nor does it pass through the seed but is readily transmitted by grafting. The white-fly *Bemisia tabaci* Gen. is the only insect vector.

The diseased plants left in the fields after harvest act as the chief source of infection for the new crop. Again if the few diseased plants that are present in the beginning if removed from a field, the disease spreads rapidly and within a month a major portion of the crop is affected.

Experiments carried out within a radius of three miles with the College of Agriculture, Poona, as the centre have shown that the disease can be effectively controlled if :—

(*a*) all bhendi plants during April and May are destroyed,

(*b*) a close season of two months during June and July is observed when no bhendi crop is grown and

(*c*) the newly sown crop is rogued at weekly intervals and all the diseased plants destroyed.

Rogueing the diseased plants at regular intervals had kept the disease within four percent, whereas in the unroguued plots it went up to 73 percent in 2½ months. The yield was similarly affected.

34. Preliminary Studies on Wing Development in Aphids.

H. L. KULKARNY, Poona.

(1) An account is given of the results of a number experiments concerning the influence of certain factors on wing development in aphids with reference to *Macrosiphum jaceae.*

(2) Result of a number of laboratory findings shows that overcrowding on the host plant alone did not induce wing development in *M. jaceae.* The laboratory findings were in support of the field observations.

(3) The period of artificial darkness ranging from 1-5 hours per day was not favourable for wing development in *M. jaceae.* It was further observed that the aphids did not reproduce normally under dark conditions and they suffered in growth.

(4) The aphids produced from alate or apterous mothers of *M. jaceae.* and reared up to three generations did not show wing development in any of the generations.

(5) Statistical analysis has revealed that temperature rather than any of the other factors tested in the experiments, such as period of darkness, over crowding or humidity is very highly correlated with wing development in *M. jaceae.* It has shown further that if there are several factors causing wing development in aphids, as may well there be, the two factors—temperature and humidity—which invariably go together, particularly temperature, are the most important of them all for promoting wing development in *M. jaceae.*

35. The Measurement of Linkage Between Characters Determined by Dissmilar Factors with Complete Dominance.

N. R. BHAT, Poona.

Alam (1929) developed formulae for the calculation of linkage between characters either or both of which were governed by two or more complimentary and or duplicate factors. He has given empirical methods of arriving at them in other similar situations.

However, the methods suggested by him are not found to be applicable to cases wherein the characters are determined by two or more dissimilar factors.

In the present paper suggestions are given, for such cases, in respect of:—

(*i*) the method to be adopted for the detection of linkage or independence,

(*ii*) the method of deriving the expectations in terms of the recombination fraction, and

(*iii*) the procedure to be adopted for obtaining the most accurate information from the data when there are more than 4 phenotypic classes in the joint segregation.

The suggestions made are illustrated with examples.

36. Land Erosion and its Control.

U. S. MADAN, Virmani.

Erosion is a combination of weathering and denudation processes and is the washing away and carrying of soil particles by water or wind or both.

Causes of erosion are fire, overgrazing, overfelling and bad cultivation.

Two types of erosion-wind and water latter is of serious danger. Sheet and Gully erosions are further types of water erosion. Hundreds of torrents emerge from denuded hills as the effect of erosion. Adverse effects of erosion are:—

(1) Increase in the intensity and frequency of floods.
(2) Decrease of dry weather flow in rivers.
(3) Silt increase in rivers.
(4) Reduction in cultivation area.
(5) Fall in water level.
(6) Silting of irrigation and hydro-electric works.

Control comprises of passive and active measures. Passive are closure to grazing and browsing and educating the masses. Active measures are by afforestation of denuded hills, digging of contour trenching, gully plugging, canalising and having shelter belts on both banks of the chos and by terracing sloping fields.

Land Erosion: Control of erosion by Nature will prove ineffective unless human activities contributing to erosion are given up. The land has its limitations, and though its yield may be scientifically increased, the over-worked land is bound to go into decay. A symbiotic relationship, taking as well as giving, is essential between man and land. From the agricultural standpoint, erosion occurs through rain, rivers, frost, wind, and sun. Cover of land by vegetation is the main single protective measure, involving creation of forest belts and growing of detached trees. Terracing, stripcropping, and contour-ridging are essential. River erosion can be countered by strengthening river banks with soil-binding plants. Floods can be checked by diverting flood-water into escape channels, from which it can be gradually drained off. Over-grazing needs to be stopped, and the live-stock reduced in number. Other sources of food, not dependent on land, should be exploited, specially river fish. Fish is destroyed in large numbers by sewage and industrial wastes discharged into rivers. Manure contents could be extracted from sewage and profitable by-products recovered from industrial wastes.

L. S. S. KUMAR, Poona.

Camphor basil (*Ocimum kilimancharicum*) is richer in camphor compared to other basils. Seed obtained from Africa was treated with colchicine to study the effect of polyploidization on the camphor content. The untreated plant has a 2n complement of 64 to 72 chromosomes. Pairing is mostly into 32 bivalents, with occasionally 4 to 6 quadrivalents. Maximum secondary association is into 8 groups and it is an Octoploid ($x = 8$). Since pairing is mostly into bivalents the species has an amphidiploid origin.

Plants treated with 0.9% colchicine solution in water were affected. Three plants examined had 128-140 chromosomes, characteristic of a 16-ploid. Maximum secondary association in the higher polyploid was nearly into 8 groups.

The camphor content of the normal and higher polyploid were determined by colorometric method. The results indicated that there was either an approximately the same or a slight reduction in camphor content. The slightly less camphor content is offset by the considerable vegetative vigour which may ultimately give a higher camphor content per acre, for determining which yield trials would be undertaken. Seed setting in the higher polyploid was considerably less than in the normal.

Cytological studies of the different species of *Ocimum* and their synthetic polyploids are in progress to determine the optimum chromosome number associated with maximum camphor content.

38. A Preliminary note of the Selective Transference of the Individual Chromosomes of *Gossypium Anomalum* to *Hirsutum* Cottons.

G. B. DEODIKAR, Poona.

The synthetic hexaploid (AA DD BB), [(hirasutum AADD x *anomalum* BB) Doubled], is being repeatedly backcrossed to *hirsutum* for transferring to it the superior fibre qualities of *anomalum* and its inmunity against the *Bacterium malvacearum* causing angular leaf spot or blackarm disease in cotton.

Observations on the B1 and the reciprocal B2 populations indicate the possibility of (1) exchange of genes between A and D sets through the bridging influence of the B genome (2) Transference of *anomalum* genes to A and D sets by their partial homologues from B genome (3) substitution of chromosomes from A and D sets by their partial homologues from the B genome. (4) addition of *anomalum* chromosomes to the *hirsutum* (AADD) complement.

Some of these expectations have been partly realised in the B2 raised from (hirsutum x B1). Differential performance of the two reciprocal B2 populations indicate that the female gametes of B1 individuals show a greater disposition for transmitting the chromosomal abnormalities as compared to the male gametes of the same individuals. It also indicates the mutual compatibility of gametes which are genomically balanced or have a near approach to that condition.

39. Studies on the Comparative Anatomy and Physiology of Two Wild *Oryza*.

G. V. CHALAM, Cuttack.

The rate of transpiration in *Oryza fatua* is found to be three to four times higher than that in *Oryza coarctata*. This difference is associated with structure of epidermis [illegible] [illegible]ata in both the species. *O.fatua* has larger and broader leaves with serrate margin, while *O coarctata* has narrow leaves with spinose margin. The latter is characterised by ridges and grooves in the inner surface and smooth outer surface, absence of midrib, larger epidermal cells with thick radial walls at the margins. Trichomes on the ridges arch over the groove and protect the motor cells. Stomata are present only on one face while in *O.fatua* stomata are present on both the surfaces and the number on upper surface is larger. Lignified cells are present in the upper part of the ridge while those are absent in *O.fatua*. In *O.coarctata* there are three on four layers of sclerotic cells below the upper or lower epidermis which are not so prominent in *O.fatua*. In *O.coarctata* number of primary veins is larger. The leaves are not easily susceptible to desiccation and leaf rolls longer than that in *O.fatua*. At the basal portion there is considerable air space between motor tissue and lower epidermis, while in *O fatua* instead of air the space is filled up with mesophyll. The leaf margins are thinner than the blade in *O.coarctata*. The motor tissue is situated at a lesser distance from the margin in *O.coarctata*, consequently it was observed that the rolling of leaf commences from the margin. *O.coarctata* has characters of a sclerophyllous plant.

Loss of water is very rapid in case of *O fatua* while the same is very slow in *O.coarctata*. In the first thirty minutes 21.3% is lost in *O fatua* while 10.85% is lost in *O.coarctata;* when the static condition is reached by both the former has lost 72.4% while the latter has lost 24.2%.

SECTION OF PSYCHOLOGY AND EDUCATIONAL SCIENCE

PRESIDENT—Prof. Kali Prosad, M.A. Ph.D.

A.—GENERAL PSYCHOLOGY

1. "Functional Autonomy".

DAMODAR MISRA, Orissa.

Psycho-dynamics has progressed rapidly in the last few years in the history of Psychology as a Science and conflcting theories of motivation have since been reconciled and have boiled down to one systematic theoretical position in the various fields of psychological investigation on the problem of motivation animal and human.

This essay has been essentially an endeavour to show the theoretical importance of the concept of "Functional Autonomy" in the final systematisation of the theory of motivation. Besides the pre-potent biological drives of the behaving organism acquired action-tendencies do also acquire a strong driving force as a variable intervening between the stimulus and the reaction. This trend of thought in building a systematic theory of motivation originated in 1918 in Woodworth's extramural lectures wich he delivered at Columbia and which later he published in the shape of a book entitled Dynamic Psychology'. "Mechanisms may become drives" was the fundamental theme which he developed and this descriptive sentence later developed into the more appropriate concept of "Functional Autonomy" in the hands of G. W. Allport. Further in what is now described in experimental literature as 'instrumental learning' the same conception is demonstrated. The instrumental character of a behaviour item acquires a driving force as strong as a pre-potent biological drive through continued repitition and reinforcement. With this the distinction between pre-potent biological drive and an acquired habit becomes one of quality and origin and the age-old behalf that a biological drive is stronger than any intellectual, social or cultural one falls to the ground. Man's acquired cultural and social needs may, in fact, be stronger at times than the pre-potent biological needs.

2. Problems and Methods in the Psychology of Personality.

H. S. ASTHANA, Lucknow.

The paper critically examines various problems that have been raised and the methods that have been employed for their solution in the Psychology of Personality. Physiological, behaviouristic, psychoanalytical and psychometric approaches haveen examined. The Gestalt and Topological theories have been examined and the contribution of the cultural and social science theories evaluated. The paper finally attempts to show that some type of physico-cultural field which need not necessarily be non-metricised provides the most satisfactory framework for studying personality dynamics.

3. Indian Typological Theories of Personality.

H. S. ASTHANA, Lucknow.

The paper attempts to analyse the different types of personalities which may be discovered in ancient Indian Psychology. A study of the types of Personality is undertaken in (*i*) the phsiogonomic and astrological literature, (*ii*) in the philosophico-psychological theories of Samkhya and Buddhism, (*iii*) in the field of Sanskrit literature (*iv*) and in the psycho-sexual and psycho-medical theories. The types are compared and evaluated in the light on the western typology. It is observed that many of the Indian theories provide a very rich variety of personality types. It is further shown that the Indian theories raise some very pertinent problems which must be accounted for by any theoiy (ancient or modern) of personality.

4. Response Psychology and Interpretation of Dreams.

SRIMANT LAL DAS, Patna.

Response Psychology has its Response Theory of Dreams. A large number of our dreams are clear cases of direct response of the inner world. Freud's wish-fulfilment is but one aspect of the more comprehensive response theory. Compensation, not wish-fulfilment, gives the correct theory of dream.

From the practical point of view, dreams may be divided into the significant and the insignificant (meaningless) dream.

The language of dreams being preeminently symbolical, key to the interpretation of dreams is to be found in the full meaning for the individual of the symbols seen in dreams.

Dreams are of vital importance to a religious soul, seeking hints, light and guidance from God. "The dreams of a prophet" says Muhammad, "are not dreams, but revelations."

Response psychology is especially interested in 'prophetic dreams' often transcending all logical calculations, predicting the future, and transforming one's character out of recognition.

The author has given an account of three prophetic dreams of his life and their interpretation.

The paper concludes with an interesting explanation of how a tiger in dream has become a symbol for Sri Krishna for the author.

5. Dream

UDAI BHANU, Indore.

The subject of dream is very interesting. From time immemorial learned persons have been studying it but the problem has remained still unsolved. This paper is an attempt in that direction.

The following conclusions are drawn from my study:—

I. Dream is the spontaneous reproduction mostly of visual forms during sleep. Sensations other than visual are hardly reproduced.
II. Colors are rarely seen.
III. Between the presentation of a stimulus and its reproduction in dream, there is the period of inactivity. It can best be called latent period. It varies considerably from man to man.
IV. The capacity to reproduce things is weakned by its activity.
V. There is no correlation between the order of presentation and that of reproduction. We never dream things in the order of presentation.
VI. Emotion and associative system reduce the latent period.
VII. Weak sensations require some period of inactivity for reproduction after stimulation.

6. Effect of Mental Set and Shift.

K. C. Mukherjee & Ajit Roy, Calcutta.

The fact of mental Set is primary in all conscious activity. Widely different response-patterns depend upon the mental Set and adjustment.

If a person is asked suddenly to stop his work in which he is engaged and is immediately asked to under-take a new work which is quite opposite in nature, he is, then to adjust himself in another way for the successful performance of this work; he is to give up his previous attitude and to adjust himself in a way, which will help him in the new work. But this adjustment requires time and practice; because the previous tendency begins to persist when another nature of work comes suddenly. So the time required for the second work will be greater than the first.

Conclusion: We have observed from a large number of cases that the shift effect is great in the case of the attentive work. This effect is greater specially in the case of the School Students than the College and the University Students. This may be due to the fact that the college and the University Students are highly intelligent and much more mature than the School Students.

B.—SOCIAL PSYCHOLOGY

7. Honesty Index—a further note.

S. N. Sastry, Bangalore.

One hundred students took the two honesty tests. The suggested index of honesty *i.e.*, H.I.—s|n x r|x.

(Where s is the total score a testee gets, n is the number of cases, r is the number of successful performances and x is the number of erucial cases) was applied and the honesty value was determined for the reaction of the subjects. The subjects were given the analogies test. They were asked to indicate on a given scale of 10 units. the position of the answer in regard to their honesty value. These are compared with the former honesty-rating and the performance in the intelligence test.

8. Security Index

N. S. N. Sastry, S. K. Ramachandra Rao, and M. C. Satyanarayana, Bangalore.

An attempt is made to study the sense of security prevailing in the middle class educated unmarried males between the ages of 20 to 25 years in Bangalore City by means of a small sample survey as a preliminary and the data so obtained is statistically analysed. It is found that the security index is normally distributed and is a linear function of factors affecting the security of an individual to a fair degree of approximation. The dominant factors which contribute to a feeling of security in a person are social, economic and personal factors in the order of their importance.

9. Role of Values in Social Relations

N. S. N. Sastry and S. K. Ramachandra Rao, Bangalore

Socialisation of the individual takes place early enough in order to enable the individual for successful social adaptation. The process gives rise to an appreciation of values which become integrated in the personality of the individual. The paper records a survey and measurement of the ideal and actual values that are thus responsible partly for the evolution of the personality. About one hundred persons took the test in which they were expected to indicate their expectation of qualities in the persons immediately in the surrounding environment. They were also told to indicate the actual results of those qualities. A comparison of these two based on statistical manipulation of the dta shows that the values have an important function to fulfill in determining social relations.

10. Measurement of attitudes in social relations

N. S. N. Sastry and S. K. Ramachandra Rao, Bangalore.

The paper is an attempt at measuring attitudes that are developed specially in relation to social factors. The personality values with reference to different individuals in the immediate social environment like father, mother, brother, sister, friend, husband, wife are the subject of the study and evaluation. The topological interpretation based on Lewin's method with certain modifications has been employed. The ideal and actual values making up an attitude with reference to the several persons in the social environment are analysed and it is shown that definite interactionism between social factors and the personality factor results in the development of the attitudes which are evaluated in the paper.

11. An Enquiry into the Drug Habit with Special Rerefence to Smoking.

C. Bheemasena Rao, Bangalore.

The paper records an enquiry into the habit of smoking, the origin of the habit, the retention and intensity and its psycho-social significance. Eighty persons took the test which was in the form of a questionnaire to be answered. The questionaire covered all the different aspect of the enquiry. The importance of the psychological factors is brought out clearly The intensity of the drug habit, ethical considerations thereof, the contribution of environmental factors are estimated on the basis of the frequency of factors as indicated in the answers to questions. This pilot survey can be usefully modified and applied over a wide area in order to elicit the proper solution to the problem already stated.

C.—EDUCATIONAL PSYCHOLOGY AND TESTS

12. Objective Tests and their place in University Education.

J. M. Sen, Calcutta.

It has often been sated that so far as the present system of examinations in the University or Board of Secondary Education is concerned the judgments and opinions of individual examiners are variable factors in human life. And unless methods are devised for controlling the variations in the opinions and judgments of each examiner there cannot be any improvement in the examination of candidates for the various types of examinations conducted by the different authorities. Therefore, as a logical corollary, abolition of examinations is urged. Should they be abolished altogether? Or, should they be remodelled on an objective basis? These are our present problems. Associated with these problems is the eternal question—what can the teachers do to improve the present situation? Can they help in controlling the variability of the factors, enumerated above? The paper discusses in detail the problems and the factors involved in conducting an examination and establishes the proposition that because of the importance of having an examination programme which gives evidence of the degree to which students are reaching each of the significant objectives of the subject an essential step in planning an examination programme is to formulate in a clear and understandable fashion the important objectives which instructor is trying to reach.

13. Distribution of Mechanical Ability among Engineering Students

S. P. SRIVASTAVA & ABDUL HAMSED.

The paper reports the conclusions of a series of investigation on the distribution of mechanical ability among civil, mechanical and electrical engineering students in the Technical schools of Lucknow. The M for civil engineering 1st & 2nd year students were respectively 34.9 and 38.2 and the S. D. for the same 9.8 & 9.2. (When the respective N were 51 and 43 representing 50% sample). Similarly the M of the 1st, 2nd & 3rd year students of mechanical & electrical engineering classes were respectively 38.7, 42.3 & 37.7; the S.D. for the same being 8.6; 10.5 and 9.1. (When the respective N were 30, 32 & 28 representing total population).

The test given to the students was the "Revised Minnesota Paper Form Board Test, series AA.

14. Hindustani Adaptation of the Pressey X—O Test of Emotion for University Students.

MISS. BIMLA, Lucknow.

The paper reports the results of the preliminary investigations on the adaptation of the Pressey Cross out Test of Emotion (revised by M. Collins) for Indian Students. The test has been considerably modified in view of the different Socio—Cultural conditions obtaining in this country. The affectivity scores range from 22 to 121. The paper gives the table of norm for Idiosyncrasies.

15. Place of Temperament and Disposition in Social Adjustment:

JNANENDRA DAS GUPTA, Calcutta.

The paper attempts to show by a compartive study of two cases the place temperament and disposition occupies in the adaptation of a person to his or her fellow-beings. The cases referred to are those of two girls who are near each other in intelligence as well as in age. The girls are seventeen and sixteen years of age and their I Q.2|5 are 75 and 65 respectively. Their scholastic success or to put it more accurately, failure show again striking similarity—The older girl had to stop her scholastic career at Class VII, while the younger girl stopped at Class VI. They however widely differ from each other in their achieved social success. While the younger girl may, with good reasons, be regarded to have succeeded in the social sphere, the older girl has failed. We have been able to undrstand that success of one and failure of the other in social adjustment is due to important temperamental and dispositional differences found in them.

The personality traits which helped the younger girl to make social-adjustment may be mentioned as following:

(1) Confidence in people,
(2) Confidence in herself,
(3) Surgency of temperament,
(4) Ability to understand others and
(5) Power of easy submission,

The older girl lacked almost all of these temperamental traits. In our two cases, we have found for social power of sumbission as the most important. At least, it is certain that the power of easy submission is one important cause in helping a wholesome social adjustment; when, however, the power of easy submission is absent, it acts as the most important cause in hampering a good social adjustment.

16. Word Frequency in the Bengali Language and A Word Book for Readers.

K. D. Ghosh, Calcutta.

This is a study of word frequency in the Benegali Language with a view to the preparation of a Word Book of about 1500 commonest words for use in Children's Readers and Adult Education Books. The list has been made up of 1000 commonest words in the Bengali Language selected both on the ground of range and frequency out of a word count of over 2 lakhs of words and about 450 words used by adult illiterates in their daily living of life.

17. Attitude to Supervision,

L. J. Bhatt, Baroda.

The Teacher and the supervisor contribute to the achievement of two difinite purposes, namely, the acquisition and development of skill on the part of the teacher and evaluating supervision,—a set of four questions were put to a batch of B.T. students to determine the helpful things that were done by the supervisor, things which were done and were not useful, help which a teacher needed most and was not given, the way in which supervision proved deterimental.—Analysis of answers—Another quiz wherein answers expected were in 'yes' or 'No' form to determine the attitude of teachers to supervision;—Discussion of answers;—phrases and expressions used by the batch arranged on a sheet and the batch asked "to cross out" the undesirable items, etc.,—discussion of results. Summary and Conclusions.

D—INDUSTRIAL PSYCHOLOGY

18. Group differences in manual dexterity among Children attenting ordinary school and the technical school.

Devendranath L. Amin, Mysore.

The paper reports the data and the conclusions obtained from five tests of manual performances administered to two groups of children having the same mean chronological age (15 to 16 years). The number of students attending routine types of technical courses is 123 and the number of students attending ordinary school is 128.

The analysis suggests that that tests involving finger dexterity show significant difference between the technical and non-technical students, while in other tests the difference is not significant though favourable to the technical students except in the threading test.

19. An analysis is of the effectiveness of the financial incentives adopted to reduce absenteeism in a cotton textile mill.

Devendranath L. Amin, Mysore.

The paper reports the monthly variations in absenteeism, the effects of absenteeism on production, the causes of absenteeism, and the financial incentives that are provided to check the rising percentage of absenteeism. Futler, the data is anlysed to determine the effectiveness of the measures adopted and better incentive method is proposed.

The data covers an experimental period of four years in a contton textile mill.

20. Fatigue and Efficiency in Textile Industries Report of work in the Weaving Section.

KALI PRASAD and KAMLA KANT, Lucknow.

The enquiry on Fatigue and Efficiency in Textile Industries started in July 1947 in the spinning section in the Swadeshi Cotton Mills at Kanpur was extended to the weaving section. Some of the preliminary findings are: Gradual rise in output from the first day of the week to the last except for Friday when it falls down and approximates to Tuesday level, maximum production in the months of November, December and January; unlike other shifts no marked improvement in performance after the rest interval in the night shift; increased output for the last hour of the shifts constitutes another peculiarity of the weaving section. The investigation is still in progress.

21. Enquiry on Fatigue and Efficiency in Textile Industries. Report of work in Spinning Section.

KALI PRASAD, H. S. DAVE and KANT, Lucknow.

The investigation in the spinning section was continued and the earlier methods of studying fatigue were improved upon. 'Relative Efficiency Ratio' and 'Criterial levels' were devised measures of output to serve as indices of Fatigue.

E.—EDUCATIONAL STATISTICS

22. Literacy Estimate for 1949.

P. D. SHUKLA, New Delhi.

Detailed figures of literacy percentage in India were worked out in the year 1931. In 1941 Census, however, such detailed investigations could not be made; but fairly exact figures of the literacy percentage in the country could be worked out from a Press Communique which was subsequently issued by the Ministry of Home Affairs (then Home Department), Government of India. The present note attempts to analyse rise in literacy during the last few years and aims at working out an estimate of the literacy percentage as it exists in the year 1949.

23. Educational Interests of Students of Philosophy.

RAM MURTI LOOMBA, Lucknow.

The paper presents the results of an investigation into the interests of stduents of Philosophy at the Lucknow University—(*a*) in the Subjects taught at the University in the Faculty of Arts, and (*b*) in the courses offered for instruction in the Department of Philosophy.

24. "Certain Aspects of work Curves.

R. RATH, Calcutta.

Work curves appear to be periodic and this periodicity can be explained as geometric. Such geometric ratios are few in number. The phase is constant. There are no oberservable indivisual differences either in the tasks involved or person working *i.e.* the curves for different tasks and produced by different persons at different times and places do resemble in their trough and crest placings.

The hypothesis is that there is a pool of all possible waves of general purpose mechanisms emergence of which is chance determined. An individual curve takes only a random handful of them. But in the long run all the waves will have a chance to appear. That is the reason why grand total curves resemble one another where as individual curves differ widely. In other words the larger the number of individual curves combined in grand total curves, the greater is the approach to a standard form or outline.

This has been demonstrated by different statistical methods such as smoothing, shaping, analysis of variance and cerrelation of curves.

F.—PSYCHOLOGY OF MUSIC AND EDUCATION

25. Psychology of the Drone in Melodic Music

B. Chaitanya Deva, Poona.

One of the basic principles of artistic technique in music is the resolution of excitation into repose. In melodio music this is achieved by the resolution of dissonance into consonace and the movement of the melody away from the base of rest into a movement towards the base. The function of the drone (as supplied by the *tambura*) is discussed from such a point of view. (1) The *tambura* suplies the tonal background necessary for the proper perception of the consonance and dissonance of the various tones in a melody. Such a background is seen to consist of (*a*) the objective overtones generated by the strings of the *tambura* and (*b*) the subjective tones—aural harmonics and combination tones—produced within the ear. The factors considered in this context are: the probable number and intensity of these tones, the effect of phase differences among them, and their mutual masking. The more prominent combination tones from the G and F types of drones are given. (2) The position and significance of the drone in a melodic movement is discussed under two heads: (*a*) as an integrator, when the drone functions as an auxilliary to a psychological base in relation to which all the notes in the melody are perceived. This psychological base, with the extenal drone as a help, integrates the melody into a whole. A probable auditory and psychological mechanism for the process is suggested (*b*) as a rest note into which the whole melody finally comes to rest. Any movement away from this creates an excitation which is eventually resolvedy by coming to rest on this note. The nature of subsidiary tonics and leading notes are discussed. In this case also, the phenomenon is primarily psychological and the drone is a subsidiary.

G.—INDIAN PSYCHOLOGY

26. Psychology and Education.

Hareram Hajrah, Asansol.

Psychology, being the Science of the mond', lies at the root of all educational theories, which are but means to some nobler end,—the right growth of a budding mind. Hence, the study of Educational Psychology calls for special attention of the educationists and all teachers, who are entrusted with the sacred charge of moulding our future hopes, through the crucible of such wise systems of education, as are requisitioned by our present needs. Guardians of young learners might be equally benefittel by the first-hand knowledge of the Psychological processes in elucation, in dealing with their less gifted wards, who are often a contant source of trouble and ansuety to them. The study of the unconscious self, expounded by the Freudian school, in particular, throws a flood of light on all the dark problems regarding the unsocial activities of the abnormals. The writer, in this article, has ably dwelt upon all such subtle questions, which may be interesting to the men of the education world.

27. "Critical Concept of Dreams in Aurveda".

K. C. Mukherjee and Sarat Roy, Calcutta.

(1) This paper deals with the theory of dreams as represented in Ayurveda. There are five types of dreams:—

(*i*) *"Anubhutas"—i.e.,* dreams of those objects which have been seen, heard or felt, this one is reproduced by past experiences.

(*ii*) *"Prarthitha"—i.e.,* dreame of those objects which are desired or the effects of fulfilled desire.

(*iii*) *"Kalpita"—i.e.,* dreams by constructive imagination.

(*iv*) *"Dosaja"—i e.,* dreams due to Pathological or morbid conditions.

(*v*) *"Baibhutika"—i e,* dreams that are premonitery of future event or prophetic dreams.

(2) Among these "PRARTHITA" and "KALPITA" dreams are nothing but "Repressed—"VASANA" (wish) of "SAGUNA-ATMA". This "VASANAS" of "ATMA" are usually repressed or suppressed by "BUDDHI" and "AHANKAR" as the case may be, which are enlightened by education, social enviornment as the person grows up. Here we find same similarity to the Freud's theory of Dreams. "BAIBHUTIKA or Prophetic dreams have some similarity to the dreams as advocated by Adler.

(3) Dreams some times manifested by "SANSKARA" and this lies in our unconscious rather in a dormant stage of mind; and this one is inherited by the son. "ATMAJA"—means Son—Son inherits this from parents. Here we find, some similarity with the theory of "Collective-unconsciousness' propounded by Jung and which is an influencing factor for guiding future life of boy. This also comes under the group of "MAIBHUTIKA" dreams!

(4) "TAMASIKA-SLESHMA", envelops the "MANAS" and thereby disconnects the chain between Manas and other "Indriyas" (Sense-organs) and causes sleep. During sleep at the "SWAPNA" stage. (dream stage) these "VASANAS", the repressed wishes of the "ATMA" reflects on its and with the help of the 'MANAS" the "ATMA" fulfils its wish or desire through this dreams and thus gets "ANNANDAM". In this stage the "MANA" becomes of another personality. During waking time when this "TAMASIKA"—SLESHMA" wane away the "MANA" forgets all the events of the past night. If this "TAMASIKA-SLESHMA" does not wane away, the personality which was playing a different role get fastened on it and the man becomes a different man of personality during waking time, and and these cause abnormality as we find in "APASMARA", Hysteria, Soldier-neurotic, etc.

28. The Place of Emotions in Yoga.

Parmanand Misra, Lucknow.

The paper discusses the place of Emotion in Patanjal Yoga. In Yoga Psychology emotions are specific differentiations of the constellations of the residual impressions (samskara-punja or Vasana-punja) embedded in the very structure of mind (vipakanugunah vasanah tah chitta bhuman asherata iti ashayah-T. V. 1-12). In other words, emotions are desires (asmita) analysable into attachment and aversion (raga and dvesha) having their respective parinama as pleasure and pain (sukha & dukha) respectively (sukhanushayi ragah: dukhanushayi dveshah-Y. S. 2-7, 8). Emotion, "begins in and looks back to, a feeling of positive Pleasure or Pain, and looks forward to and ends in, in possible Pleasure or Pain". The mind is to be rid of all the agreeable or disagreeable emotional distractions and attendent tensions (Y.S. 1-31) in the processes of ekatatvabhyasah (Y.S. 1-32) and vairagya (Y.S. 1-15). The physiological emotional changes are of course, observable in Asana (Y.S. 2-46) and Pranayama (Y.S. 2-49) two of the Ashtangas (Y.S. 2-29).

SECTION OF PHYSIOLOGY

PRESIDENT: SHRI KALIDAS MITRA, M.B., D.P.H., D.T.M. & H., F.N.I.

Pharmacology

1. Effect of Sodium-acetate on Pancreatic Digestive Enzymes.

M. C. NATH AND V. G. HATWALNE, Nagpur.

Influence of sodium acetoacetate on pancreatic digestive enzymes were studied and the following observations were recorded: (*a*) Pancreatic amylase is slightly inhibited by Na acetoacetate, (*b*) Pancreatic lipase is also slightly inhibited by Na acetoacetate, (*c*) Pancreatic amylase is inhibited to a greater extent than the pancreatic lipase by Na acetoacetate, and (*d*) Proteolytic activity of pancreatin is not affected by Na acetoacetate.

2. Studies on Experimental Diabetes.—Part II.

Effect of acetoacetate on the lactic acid and vitamin C content of the blood in rabbits, and the additional influence of amellin and insulin.

M. C. NATH AND C. H. CHAKRABARTI, Nagpur.

Sodium salt of acetoacetic acid when injected into the normal animals (rabbits) in increasing doses beginning from 50 mg per kg. body weight, increases blood lactic acid enormously. After 90 days of such injection, the average value of blood lactic acid rises to 92 mg from the observed average value 12 mg per 100 c.c. of blood.

Plasma ascorbic acid is reduced to 1.10 mg from 2.72 mg per 100 c.c. after 40 days of such injection in another set of animals receiving about half the dose of acetoacetate.

Administration of amellin (injection), prevents the accumulation of lactic acid in the blood of the animals receiving sodium acetoacetate injection for 90 days and brings the value to the normal limit within 40 days.

Insulin, on the other hand, is not found so effective when injected in another set of treated animals for 40 days. The blood lactic acid diminishes initially but rises again in spite of continuation of insulin injection along sodium acetoacetate.

Amellin treated animals showed better state of health than insulin treated ones.

3. Studies on Experimental Diabetes.—Part III.

Effect of sodium acetoacetate in increasing such other constituents of blood as are high in diabetes and the beneficial influence of insulin and amellin.

M. C. NATH and (MISS) BHAVANI BELAVADY, Nagpur.

Continued injection of sodium aceto-acetate in the normal animals (rabbits) brings about a progressive increase in the urea and inorganic phosphate of blood. Blood cholesterol shows alternate increase and decrease. Urea and inorganic phosphate of urine also are found to increase considerably. Both amellin and insulin help to bring the concentration of these constituents to the normal limits, the effect of amellin being much greater than that of insulin.

4. Effect of Feeding Thyroprotein and Removal of Tablets on Lactation Induced by Implantation of Stilboestrol.

A. ROY, S. BHATTACHARYA, S. N. LUKTUKE AND P. BHATTACHARYA, Izatnagar.

A group of virgin goats were implanted with Stilboestrol tablets. Removal of all stilboestrol tablets left in situ after the induced lactation curve had reached its peak caused a considerable increase in milk yield. This increase in milk yield was not due to greater intake of food following the disappearance of the inhibitory influence of Stilboestrol on food intake, because this was kept at the same level throughout the experimental period. Feeding of iodoprotein after the stillboestrol induced lactation curve had reached its peak appears to bring about increase in milk yield. Simultaneous feeding of iodoprotein failed to bring into milk, those goats in which lactation could not be induced by the implanatation of stilboestrol tablets.

5. Effect of Feeding Thyroprotein (Protamone) on Goat Semen.

D. P. MUKHERJEE AND P. BHATTACHARYA, Izatnagar.

In some previous experiments it was observed that during the season characterised by high environmental temperature and humidity, the semen quality of farm animals is poor. An attempt has been made to improve the semen quality of goats during this season by administration of thyro-active substance. The experimental animals consisted of 14 adult goats which were evenly distributed in two groups on the basis of their semen production in the pretreatment period. The animals of the experimental were fed with 1 gram of thyroprotein (PROTAMONE) daily for a period of 16 weeks during May to August 1949. The semen samples from both groups of animals were examined for the following attributes,

(1) Volume,
(2) Sperm concentration per c.c.
(3) Total number of spermatozoa per ejaculate.
and (4) Percentage of abnormal spermatozoa.

The 'reaction-time' was also recorded. It has been observed that sperm concentration increase considerably due to thyroprotein feeding. No appreciable difference have been observed in other characteristics.

6. A Study on the Corticomimetic Effect of Stilboestrol.

A. RAY, Y. R. KARNIK, AND P. BHATTACHARYA, Izatnagar.

Stilboestrol was implanted subcutaneously in a group of ewes in graded doses and left in situ for 64 days, while another group was kept as control. It was found to cause a statistically significant rise in the glucose and non-protein nitrogen content of blood. Plasma ascorbic acid content was not affected, but cholesterol concentration of plasma showed a progressive rise.

The moisture content of liver and adrenal showed slight decrease which is statistically significant in adrenal but not in liver.

Liver glycogen and fat content was significantly more in the treated group than the control. The difference in the liver cholesterol content was not significant statistically.

Ascorbic acid and cholesterol content of the adrenals of the treated group was lower than the control.

Some of the observations made provide further evidence to justify the theory that stilboestrol primarily augments adreno-corticotrophin secretion from the pituitary and thereby brings about a hyper secretory activity of the adrenal cortex. Hence the characteristic effects which are associated with the adrenal cortical hormones.

7. Collection and Preservation of the "Follicle Stimulating Hormone" like Substances in Urine by Ultrafiltration and their Biological Assay.

S. K. GOKHALE, Poona.

In recent years much attention has been directed towards the determination of hypophyseal hormones in urine, as it affords a great diagnostic help in a variety of endocrine disorders. The ultrafiltration technique introduced by Gorbman (Endocrinology 27, 177, 1945) is relatively simpler as well as accurate, as compared to some other techniques like the alcohol precipitation method etc. The present work describes the technique in the light of the experience and observations in the application of the ultrafiltration method as follows: (1) the preparation of the collodion membrance, (2) the filtration vessel, (3) the filtration, (4) the collection, precipitation and extraction of the hormone, and (5) the assay, Results of FSH assays on urines of some normal and pathological subjects have been presented.

8. On the Colorimetric Method of Determination of Pteroyl Gultamic Acid and Related Compounds in Liver Extract Concentrate.

S. K. GANGULY, Calcutta.

In the colorimetric method of determination of Pteroyl glutamic acid and related compounds in liver extract concentrate according to the method of Hutchings *et al.*, (J. Biol. Chem. 168.705, 1947) uniform results were not being obtained in our hands. Treatment with chloride in presence of alcohol (90 per cent by volume) at PH 8.0 however, helped in the quantitative precipitation of the pteroyl glutamic acid and the related compounds from liver extract solution. Separating the precipitate by centrifugation and suspending the same in water, determination could be easily carried out by the above method using urea in place of amonium sulphate.

9. Influence of Phloridzin on Blood Vessels of Frogs.

N. M. BASU, Calcutta.

After pithing a toad weighing 110 g one branch of the aorta and lower part of sinus venosus were both nicked to drain out as much blood as was possible. A ligature was then tied round the other part of the aorta and the preparation perfused with cooled Ringer's solution. After thoroughly washing all the traces of blood a glass tube with a bulb at one end was pushed through fine incision in the sinus venosus, which was ligatured above the incision. The toad was then suspended by a clamp and Ringer at room temperature was perfused under pressure. Pressure of perfusion fluid was kept constant. Electric circuit was also established to record the flow of the liquid in the aortic consula. It was noticed that phloridzin brings about a marked constriction of blood vessels, adrenalin does it to a lesser extent and acetyl-choline brings about definite dilatation of blood vessels.

10. Hypoglycemic Action of Alloxan.

SACHCHIDANANDA BANERJEE, DULALPADA SADHU, NARESHCHANDRA GHOSH AND HARIPADA CHATTOPADHYAY, Calcutta.

The initial hypoglycemia after the injection of alloxan is due to the liberation of insulin from the islets cells of the pancreas which are damaged by alloxan. Some claims have been made that alloxan hypoglycemia is extrapancreatic in origin and Houssay (1945) suggested that hypoglycemia is due to the lack of formation of glucose by the liver. Glycogen content of the liver of rabbits dying of hypoglycemic convulsions after the injection of alloxan was therefore determined and the value was compared with those of rabbits dying of hypoglycemic convulsions after the injection of insulin. The glycogen value of the livers of both alloxan injected and insulin injected animals were considerably diminished as compared to the values in control animals. There was no stoppage of glycogenolysis in the liver of alloxan injected rabbit. Both the alloxan injected and insulin injected showed similar symptoms and it is suggested that the alloxan hypoglycemia is pancreatic in origin.

Summary

11. Preliminary Investigation on the Pharmacological Action of Diamidino-Diphenylamine Dihydrochloride (a new remery for Kala-azar fever.)

GUPTA, J. C. & CHATTERJEE, M. L.

Pharmacological action of a new compound of aromatic diamidine (viz: *Diamidino-Diphenylamine Dihydrochloride*) prepared by Dr. A. J. Ewins, has been under investigation. Its toxicity LD50 has also been suggested in the present paper to be 22.5 + 2.5mgm|kgm. The result of pharmacological action indicates that the drug has a depressant effect on blood pressure which is brought about greatly through central action and partly through peripheral parasympathetic effect and action on blood vessel. The drug seems to possess a direct depressant effect on plain muscle of blood vessel and also on myocardial tissue.

Biochemistry & Analytical Chemistry

12. Tocopherol Content of Edible Oils and Fats.

T. A. VEKATASUBRAMANIAN AND B. N. BANERJEE, Bangalore.

The tocopherol content of a few vegetable oils have been estimated by a modified Emmerie-Engel method. The tocopherol content of the fats were:—coconut oil, 0.03, groundnut oil, 0.52, Sesame oil, 0.48, cottonseed oil, 0.81, and a hydrogentated groundnut oil, 0.46 in mgms per gm of oil. The effect of hydrogenation on the tocopherol content of a number of samples of groundnut oil showed that there is no appreciable decrease in the tocopherol content due to hydrogenation. Cottonseed oil was found to contain the maximum tocopherol.

13. Studies in Indian Edible Oil—Coconut Oil.

K. RAMA MURTI AND B. N. BANERJEE, Bangalore.

In continuation of our previous work on groundnut and sesame oils cocoanut oil was investigated with special reference to the methods of extraction, storage, *in vitro* digestibility and stability of carotene and vitamin A dissolved in it. 25% of the market samples in Bangalore were found to be adulterated. The f.f.a. of the samples was not very high. Since samples with low f.f.a. showed high Kreiss value probably the products responsible for the latter were the primary products of disintegration. An oil with only 0.02% f.f.a. can be obtained if fresh kernels dried to about 3% moisture are crushed in the cold. Heat treatment of the kernels adversely affects the keeping quality of the oil. Steam distillation reduces the peroxide value of high f.f.a. oil. Samples of varying f.f.a. and kreiss value, showed very little difference in hydrolysis by lipase, probably due to the better emulsifying properties of the lower acids in cocoanut oil. In low concentration, the stability of vitamin A in cocoanut oil decreases proportionally with temperature, acidity, and peroxide value of the oil.

14. Nickel in Hydrogenated Fats.

T. A. Venkatasubramanian and B. N. Banerjee, Bangalore.

The nickel content of hydrogenated fat sold in the Indian market has been analysed. Over 200 samples collected from all over India gave values below one part per million Generally the value is 3 to 25 micrograms of nickel per kilogram. It may be said, therefore, that no harm need be feared from the presence of nickel in Vanaspati's sold in India.

15. The Antioxidant Activity of Sesame Oil in Hydrogenated Fats.

T. A. Venkatasubramanian and B. N. Banerjee, Bangalore.

As vanaspati sold in India now-a-days contains at least 5% of sesame oil or hydrogenated sesame oil, the effect of the addition of this constituent on the keeping quality of the product was studied. The storage property was judged by the induction period in an atmosphere of oxygen at 70°C. It was found that addition of 5% sesame oil to hydrogenated groundnut oil of melting point ot 37°C. increased the stability by 70% and that of melting point 41°C. by 50%. In all cases, the end of the oxygen absorption coincided with the sample developing a peroxide value of about 12 m. equivalents per kg. However, the sesame oil must be from healthy seeds and cold drawn with acidity not more than 0.5%.

16. Determination of Vitamin A in Capsules and Tables in Tropical Conditions—A Comparative Study.

N. K. Iyengar and B. Mukerji.

Vitamins in capsules and tablets are imported into this country in considerable quantities. These are ordinarily stored under the tropical climatic conditions prevailing in the country.

A study of the deterioration of Vitamin A in tablets as compared with capsules has been made. Capsules and Tablets with potencies of 500 units were stored in the laboratory for a period of one year. The maximum temperature and humidity for the greater part of the year were 95°F and 80—90% respectively. At the end of one year a loss in potency of 50% in capsules as compared with 75% in tables was recorded. It appears from this study that as far as Vitamin A is concerned capsules are preferable to tablets for use and storage in the tropics.

This comparative study will be extended to other vitamins.

17. Determination of Vitamin A with the Lumetron Photo-Electric Colorimeter.

N. K. Iyenger and B. Mukerji

The possibility of employing Lumetron E F 402, the photo-electric colorimeter and fluorimeter for the determination of vitamin A with the use of the combined glass and special liquid filter has been investigated

The calibration graph which is a straight line showing the relationship between the logarithm of transmission and the potency of vitamin A has been prepared. For this purpose vitamin A with a potency of 1,500,000 units supplied by the B.D.H. was used.

In order to test the efficacy of the combined glass and special liquid filter, the absorptions of various concentrations of Arachis and Olive oils in Isopropyl alcohol not containing vitamin A, have been determined. It has been found that these oils in concentrations of 0.015% do not show any absorption while in concentrations above 0.03% there is a gradual increase in nonspecific absorption interfering with the estimation of vitamin A.

Oils not containing vitamin A were mixed with standard vitamin A to obtain concentrations of 3,300 and 1500 units per gram and then tested with the instrument both directly as well as after saponifaction. Preparations with potencies of more than 3,000 units gave very accurate results while those containing 1500 units gave considerably higher values, presumably due to nonspecific absorption of the oil being added on to the specific absorption of vitamin A.

Carr Price blue values on fish liver oils, vitaminized oils and capsules were determined and compared with the potencies as determined by the Lumetron. The average factor for the conversion of blue values to International units is approximately 57 which should be used as a rough guide.

It is concluded that the Lumetron E F 402 with the combined glass and special liquid filter can be safely employed for the accurate determination of vitamin A in preparations with a potency of more than3,000 units.

Physiology

18. Studies on Vitamin A in Solution.

U. P. Basu and Sukhamoy Bhattacharya, Calcutta.

Vitamin A is now often being obtained in a concentrated form, and is being marketed in the form of a solution in edible oil. But as edible oil may develop rancidity on storage, the potency of vitamin may undergo deterioration on storage. This change can be controlled to a considerable extent by incorporation of some suitable antioxidant. A systematic study on the stability of vitamin A in different solvents and that again in presence of different antioxidants in varying concentrations have been studied and are being described in the present paper.

In the course of the investigation it has been noted that unsaturation in diluent is not the sole cause of deterioration of Vitamin A molecule in solution. The antioxidant (phenolic) is found to exert a better effect in protecting the vitamin A molecule when the system contains an ester or glyceride molecule. Systems studied are arachis oil, ethyl oleate, ethyl stearate, glyceryl monolourate, and liquid paraffin. Antioxidants used are monomethyl hydroquinone and propyl gallate.

19. A Comparative study of acid and Enzymic Extractions of Nicotinic acid from Foodstuffs.

Kamala (Bhgvat) Sohonie and U. C. Misra, Bombay.

A procedure for the extraction of nicotinic acid from foodstuffs with 2 N Hcl and with an enzyme preparation from the pigs' intestinal mucosa has been described.

The two modes of extraction have been shown to yield different values for nicotinic acid—enzymic extraction of pulses yielding higher values for nicotinic acid, while acid extraction of oil seeds and cereals gave bigger values. The discrepancy has been suggested to be due either to the presence of an alkali labile precursor of nicotinic acid or a non-specific chromogen. Groundnut, barley and black gram have been found to contain a precursor.

Whether this precursor is biologically active for man is not known, but it has been suggested that the values for nicotinic acid obtained by the enzymic extraction of foodstuff, may represent, the amount that is biologically available for man.

20 On the Estimation of niacinamide by Cyanogen Bromide Reaction.

N. RAY, Calcutta.

A critical study of the cyanogen bromide method of estimating niacin and its amide has been made. Control of temperature within the limit of 22°C. in developing the colour of maximum intensity and stability is found to be an indispensible factor. Sulfanilamide may replace aniline. Moreover it is found that sulfanilamide develops a colour of higher intensity than aniline.

21. A Study on the Reducing Substance of Semen.

A. ROY, Y. R. KARNIK, S. N. LUKTUKE, S. BHATTACHARYA AND
P. BHATTACHARYA, Izatnagar.

The concentration of total reducing substance and fruetose present in semen obtained from buffaloe-bulls, goats and rams have been estimated by the method of Hagedorn and Jensen and Roe respectively. The ascorbic acid content of semen of buffalo bulls and rams has been estimated by the method of Bessy and King. The mean total reducing substance, fructose and ascorbic acid content of buffalo bulls is 875, 615 and 3.7 mg. % respectively. By difference the concentration of nonfructose residue is 260mg%. Corresponding figures for ram are 623, 529, 5.10 and 94 mg %. The total reducing substance and fructose content of goat semen is 548 and 465 mg %.

Nutrition

22. Biological Value of Common Fish Proteins in Orissa.

K. SUBRAHMANYAM AND S. M. BANERJEE, Cuttack.

The Nitrogen balance sheet method of Mitchell as modified by later workers was used in the determination of Biological values of Hisla, Prawn, Rohi and Katla—the most common varieties consumed in Orissa. They were found to be:—

Hilsa	75.5%
Prawn	64.6%
Rohi	58.0%
Katla	51.0%

23. Effect of Heat Treatment and Acid Extraction on B. V. of Fish Proteins and the Presence of a possible Anti-enzyme which tends to lower B. V.

K. SUBRAHMANYAM AND S. M. BANERJI, Cuttack.

Biological values of common fish proteins were found to progressively increase after drying at temperatures from 60 C. to 10° C. The same increase in B. V. can be effected by removing a certain factor present in the fish meal by extraction with HCI (PH—4.2). The presence of an inhibitor in the extract which is responsible for the low B. V. (when the fish is dried at a lower temperature) can be demonstrated by adding the acid extract to the fish meal dried at a higher temperature of 100° C. when the high B. V. is lowered. The mechanism of action of the inhibitor appears to be by retarding the tryptic activity.

24. The Increase in Ionisable Iron in Various Vegetables after Intestinal Digestion.

K. SUBRAHMANYAM AND S. M. BANERJI, Cuttack.

Doubts have been cast regarding the indentity of utilisable iron with ionisable iron. Samples of different foods, of which the ionisable and total iron were previously determined were digested with intestinal mucosa of sheep at 37.5° C. for 6 hours at pH 8 under anoerobic conditions. There was an appreciable increase in the ionisable iron possibly due to enzymic activity, which converts part of the non-ionisable iron into ionisable iron. The increase in the quantity of ionisable iron after digestion explains how such foodstuffs were found to contain more utilisable iron than is warranted by their previous low content of ionisable iron.

25. Studies on the effect of Germination on the Phytin Content and Phytase Activity of some Common Indian Pulses.

SACHCHIDANANDA BANERJEE AND NIRMALENDU NANDI, Calcutta.

Phytin content and phytase activity of four varieties of pulses (*Phaseolus mungo, Phaseolus radiatus, Cicerarietinum and Dolichos lablab*) have been estimated both before and for varying periods after germination. Phytin content gradually diminished along with the increase in the phytase activity of the germinating pulse which was maximum either on the third or on the fourth day of germination.

26. Studies on the Biosynthesis of Nicotinic Acid. Biosynthesis of Nicotinic Acid by Germinating Pulses.

SACHCHIDANANDA BANERJEE AND RAMAPRASAD BANERJEE, Calcutta.

A number of cereals and pulses have been shown to elaborate an increase amounts of nicotinic acid during germination. Pulses show a regular increase whereas with cereals the rise is comparatively small.

Trigonelline content of *phaseolus mungo* has been found to diminish to a considerable extent in contradistinction to the rise in the nicotinuric acid content and nicotinic acid content during the process of germination.

Chloretone and tryptophane have been found to enhance the production of nicotinic acid in germinating *phaseolus mungo* while ornithin, valine, methionine, phenylalanine, cystine, isoleucine, menthol, camphor, barbitone, pyridoxine and choline have no such effect.

An alkali-labile precursor of nicotinic acid claimed to be present in wheat bran has also been found to be present in barley and paddy but not in maize. This is found to be diminished during the process of germination. This precursor is absent in pulses.

27. Dietary Habits of Depressed Class (Dusadh & Chairo) in Palamau.

S. B. LAL, Patna.

Dusadh and Chairo belong to the depressed classes (Harijans). No studies regarding their dietary habits have been made so far in this province. The present paper deals with the dietary habits of those persons residing in the district of Palamau. With the diet surveys nutritional survey of the children of the same families were also carried on. 25 families of each of the Chairo and Dusadh consisting of 121 and 136 members were carried out. Economically they belong to the very poor strata and the daily income per consumption unit in annas was 1.4 to 2.3 only. The calorie intake was strikingly low and 84% of Chairo and 60% of Dusadh were consuming less than even 2,200 calories as suggested by Nicholl's. There was very low intake of protective foods. Consumption of milk was low and there was complete absence of flesh food, oils and fats. When compared with other sections of different castes and groups of the province of Bihar, Chairo and Dusadh were found to be poorer and consuming less than the other groups of population who have been surveyed.

28. Use of Defatted Groundnut Cake as food.

S. B. LAL AND A. BOSE, Patna.

Groundnut has long been used as human food but the excessive fat content in the kernel limited its use in large quantities. In the investigation under report an attempt was made to determine the amount of pulverised defatted kernel which could be consumed by adults without loss of health or digestive disorders. The investigation has indicated that upto a maximum of 1.5 oz. of the defatted ground nut kernel can be consumed daily with safety if it is mixed with wheat flour and cooked as chapathi (unleavened bread). Such chapathis were found to be palatable. Mixture of the defatted kernel in the form of thickening agents to pulse gruel or vegetable curry did not evoke a favourable response from the consumers. The feeding trials were held in a local orphanage. Sweets prepared with defatted kernel, Bengal gram flour and sugar with added fat were relished by the consumers.

29. The Effect of Diet on the Susceptibility of Rat to Rats Leprosy.

KAMALA (BHAGVAT) SOHONIE, Bombay.

The effect of diet on the susceptibility of rats to rat leprosy has been tried. It has been observed that the susceptibility of rats to rat leprosy is not dependent on the type of the diet, further a supplementary supply of the vitamin B complex did not—increase the resistence of rats to this infection.

30. Ascorbic Acid content of Ovary and Corpus Luteum during various stages of Oestrous Cycle and early Pregnancy.

A. ROY, S. N. LUKTUHE, P. BHATTACHARYA, Izatnagar.

The ascorbic acid contents of the ovary obtained from she-buffaloes at various stages of the oestrous cycle have been estimated. Of the two ovaries from the same animal the one freshly ovulated was found to contain 19.38 mg|100 g and the other 15.56 mg. The higher concentration in the former was found to be statistically significant. The ascorbic acid content of the ovaries in various other conditions studied was found to be of the same order.

Persistant Corpus luteum, compared to normal Corpus luteum, is characterized by a very low concentration of ascorbic acid.

Ascorbic acid content of Corpus Luteum obtained from pregnant animals did not differ from that obtained from non-pregnant animals.

31. Effect of Vitamin B1 on Circulation.

S. M. BANERJI, S. TEJ AND J. SENAPATI, Cuttack.

The following methods were used:

(*i*) Frog's heart perfusion,
(*ii*) Dog's blood pressure,
(*iii*) Direct electrogram of frog's heart.

As a result of these studies it is found that Vitamin B1 has the effect of initial depression followed by accleration and augmentation of the heart beat. The depression is less marked after previous atropin administration. The blood pressure is not much affected. In minute doses the depression and stimulation effects on heart are not seen. It is proposed to extend the work on human beings.

32. Quality of Blood in Women Medical Undergraduates.

(MISS.) S. CHAUDHURI AND K. MITRA, New Delhi.

An attempt was made to study the concentration of the more important constituents in the blood of 30 apparently healthy undergraduate students at the Lady Hardinge Medical College. The average Hb value (Sahli) was found to be 10.5g|100ml with a maximum of 12g and a minimum of 8.5g. The average RBC Count was 4m. per cmm, the lowest figure recorded being 3.6m and the highest 5.2m. Plasma protein concentration was estimated by Van Slyke's specific gravity method. In fifty percent of the subjects protein figures did not come up to 7g|100ml, even a figure as low as 4.5g has been recorded. The albumin-globulin ratio was in the order of 2: 1. Inspite of the fact that no published figures for plasma protein value of adult Indians are available the sum total of the observations tend to confirm the belief that the general standard of health of the people has appreciably deteriorated within the recent years.

33 Haematological studies including Plasma Protein values in Nutritional Anaemia.

(MISS.) S. CHAUDHURI AND K. MITRA, New Delhi.

This study was undertaken to investigate the changes effected in the quality of blood of women suffering from Anaemia presumably caused by malnutrition. Altogether 35 women weighing 112-120 lbs each were examined of which 15 were pregnant. Dietary history revealed that the daily calorie value of their diet at home ranged from 1000 to 1600 on a liberal estimate. Haemoglobin concentration was below 50 percent in all these cases and the RBC Count was in the neighbourhood of 3 millions. Plasma protein concentration did not come up to even 5g|100ml in two-third of the subjects. It was significant to note that such low figures were associated even with low blood volumes. Albumin-globulin ratio ranged from 0.7: 1 to 3.5: 1. The albumin-globulin ratio was lowered inspite of the fact that there was no urinary excretion of albumin. An apparent correlation could be discovered between the plasma protein and haematological values. The subjects were put on high protein diet and protein hydrolysates by mouths. The response was very favourable with regards to plasma protein concentration and albumin-globulin ratio. Medication with iron liver extract or Folic acid either alone or in combination was not as effective as when proteins were added.

34. Hematopoetic Property of Iron in Autoclaved Soyabean and Soya-Milk and its Utilization in Normal Rat.

K. SUBRAHMANYAM, MISS. VANAMALA SATHE AND S. S. DE, Bangalore.

The hematopoetic activity of autoclaved Soya bean and processed soya-milk was compared with Ferric chloride on growing rats by following the haemoglobin level and iron stored during the experimental period. It was found that 92.5 per cent of ionizable iron in autoclaved soyabean is utilizable for haemoglobin regeneration and the iron in the autoclaved soyabean is about 90 per cent ratained as compared to Ferric chloride. In the case of soya-milk the values were the same as that of autoclaved soya-bean.

35. "Investigations into the Dietary Habits of the Aboriginal Tribes of Abor Hills (Assam)"

P. N. SENGUPTA, Calcutta.

Investigations into the dietary of 46 families consisting of 304 persons and on the general living conditions, economic status, education and food habits of all the 507 families consisting of 2203 persons of ten villages of Abor Hills on the Indo-Tibetan frontier were carried out during the winter of 1948-49. Males and females were found to be in the ratio of 1 :1 to 1 :1.3 and the children were 24-29% of the total population. 22.4 to 58.8% boys were receiving free primary education. Paddy was mainly raised in the lower regions but *Annyat* (*Coix Lachryma*) was the main crop in the upper regions. 39-70% families had sufficient food grains raised from their own field for the year's consumption. The diet surveys were carried out for 7 days in each family and the intake of various kinds of foods as well as of the different nutrients present in these foods were calculated on per consumption unit (C. U.) per *diem* on the basis of the League of Nations scale of the family coefficients. *Apong*, a beverage from fermented cereals, contained 2-4% alcohol and many nutritive principles. Milk, oils and fats, sugar and jaggery, pulses and condiments besides chillies were not used as foods and leafy vegetables constituted the main 'protective food'. Calorie consumption did not exceed 4000 in any family. In group I and II average calorie intake was 3115 and 2810 and of these respectively 91.6% and 93.9% were derived from the cereals. 33.3% and 57.9% families of these two groups were short of minimum requirement of calorie. Average protein intake though adequate *i.e.* more than 10 g, yet the animal protein was only 2.5-15%. Average Ca, P and Fe intake were: Group I-Ca-1.12 g, P-3.39 g, Fe—32.3 mg, Group—II—Ca-0.88g, P-2.98 g and Fe—29.3 mg. More than 50% families were deficient in carotene and vitamin A intake. Following were the quantities of vitamins provided by the diets: Group-I-vitamin B1—1.6 mg., Riboflavin—0.31 mg, Nicotinic acid—37.3 mg and vitamin C—82.7 mg. Group II—Vitamin B1—1.4 mg, Riboflavin—0.25 mg, Nicotinic acid—33.5 mg and vitamin C—49.3 mg. Anthropometrical measurements revealed that the children were heavier than the children of the Indian plains but their weight was at par with those of the American children.

36. Effect of Proteolytic Inhibitor on the Supplementary Effect and Biological Values of Different Varieties of Soya-bean.

S. A. RAHAMAN and S. S. DE, Bangalore.

Thirty varities of Soyabean have been examined for their proteolytic inhibitor content and a difference was observed between different varieties. The biological value and supplementary effect to poor rice diet was found to vary with their inhibitor content. S. B. Pyneagne with 24.02 degree of inhibition has a biological value of 77.91 and supplementary value of 5.7 while S. B. 3 Black having higher degree of inhibition (39.03) has lower biological value and supplementary effect the value being 60.8 and 4.9 respectively.

37. Studies on the Nutritive Value of Soyabean.

MISS, S. GOWRI DEVI, J. GANGULY & S. S. DE, Bangalore.

The effect of germination on the nutritive value of protein of Soyabean was determined by rat growth method and it was found that biological value of raw soyabean was 0.95 while that of bean germinated for 48 hours was 1.34. The biological value of proteins in soyamilk prepared from 48 hours germinated beans was found to be 1.40 as against 1.44 of the proteins of cow's milk.

General Physiology

38. A Study on Saliva in man.

M. L. Chakraborty and S. K. Sen, Calcutta.

An investigation into the ptyalin activities of saliva of man has been carried on. Wohlgemuth technique as modified by E. C. Dodd (British Journal of Experimental Pathology 1922, iii, 133) has been followed. The ptyalin content varied from 2650 to more than 20,000 units. From the investigation so far carried on, there has been found no indication of the Ptyalin content being more 'n vegetarian than in non-vegetarian. It would, however, show variations according to the stimulus used.

39. Normal Electrocardiogram in Orissa.

S. M. Banerji, S. Tej and J. Senapati, Cuttack.

Electrocardiogram of 50 healthy young men-average age 19 were taken by G.E.C. aapparatus and Phillip's Cardiotron. The curves obtained by both the instruments from the same person gave identical curves. The various components of the E.C.G. were critically analysed and their average, minimum and maximum readings were noted for comparison with literature and for use as nomal standards here. The following is a brief summary of the findings:—

Cardiac cycle ..	76 sec. (minimum. 52; maximum 1 04)
Heart rate ..	79 per minute, (minimum 58, maximum 115)
Rhythm	Regular 37, Sinus arrhythmia 13
P	Average duration .08 sec, Average height 1.17mm Inversion of P3 one case only.
P. Q interval ..	Average maximum .15 seconds (minimum .12 Maximum .18)
QRS complex ..	Average duration .0768 sec. Average maximum height 8.89 mm (minimum 4, max 14). L. A. D. present in 13 cases, R.A.D. present in 3 cases, R3 notched in 7 cases, Q3 prominent in 5 cases (Q|R 1|3 to 1|7).
QT—ventr. systole ..	Average duration .35 seconds (minimum 42. Max. 27).
St segment ..	1 to 3 mm above isoelectric line in 7 cases 1 mm down in one case. Concave in 8 cases, convex in 9, flat in the rest.
T	Maximum average duration .20 sec. Maximum average height 2.69 cases T3 inverted 14 cases.
TP—diastole ..	Average duration .26 seconds (minimum .08 Max. 52).

40. Gelatin as a Transfusion Material in Experimental Haemorrhagic Shock

M. Damodaran, E. K. Narayana, Gurdas Singh & M. B. Gharpure,
Poona.

Gelatin prepared in the laboratory from the long bones of goats has been transfused as a 6% heat sterlised aqueous solution in 5% glucose and 0.9% sodium chloride at pH 7.0, in amounts of 250 cc. in dogs (average weight: 12 kg.) and 75 cc. in cats (average weight: 3 kg.) subjected to severe haemorrhagic shock (rapid depletion of about 50% blood volume) and compared with glucose saline. Observations have been made of the blood pressure and respiration of the animals from the beginning of the hæmorrhage till 3 hours after the end of the transfusion or the death of the animal, whichever was earlier.

It has been observed that gelatin, unlike the crystalloids, maintains a large measure of the resuscitated blood pressure and helps the animal to survive shock. No alarming respiratory disturbances have been noted. Some gradual lowering of blood presure observed during the post transfusion period was attributed to the diffusible nitrogen content of the gelatin. The work is being continued by extending observations to blood volume changes as well, with preparations of gelatin obtained by different methods of processing.

41. Testing 'Local Anaesthetics' by "The Frog's Sciatic Nerve Sensory Block" Methods.

Ranita Aiman and M. B. Gharpure, Poona

While testing the local anaesthetic property of some compounds by the above method it was not found possible to obtain comparable results. The factor responsible for this, was thought to be the weight of the frog used which would influence the size of the nerve. No reference in literature as regards the choice of the frog with respect to its weight, could be obtained. From the results of four experiments given below it is clear that the weight of the frog used is a point of considerable importance, in the testing of local anaesthetics by the frog's sciatic nerve sensory block method.

COMPOUND	Weight of the frog. (in grams)	Time for the appearance of anaesthesia.
2:4 dimethoxy benzhydrylamine hydrochloride.	145	29 min.
,, ,,	381	43 ,,
p p' dimethyl benzhydrylamine	175	34 ,,
,, ,,	345	80 ,,

Further work on this point with a view to standardize this method, as far as the weight of the frog is concerned, is in progress. It is hoped that the work would be completed by the end of December, 1949.

42. Effect of Addition of Fresh Kephalin on the Sustenance of a Frog's Heart Beat by Perfused Ringer Solution.

N. M. Basu, Calcutta.

It is well known that if frog's heart be perfused with Ringer's solution at PH varying from 7.2, to 7.4, it continued to beat for a long time, but the heart becomes gradually hypodynamic, and the auricles and the ventricles, particularly the auricles, become gradually dilated. It is also known that the heart muscle contains more phosphatides (Lecithin and Kephaline) than sketetal muscle. It has been also shown that lecithin and Kephalin in colloidal solution can pass through animal membranes (Bloor). It was surmised that hypodynamicity might be due to slow diffusion into the perfusing fluid of lecithin and Kehpalin from the cardiac muscle. Accordingly experiments were performed to ascertain whether the addition of lecithin or Kephalin would maintain the normal heart beat for a long time. It was found that lecithin had no effect but the addition of freshly prepared Kephalin (25 mg. in 100 cc Ringer) had a pronounced effect on the sustenance of normal well-marked heart beat for over 4 hours, after which the experiment was stopped.

43. Thyroid-Adrenal Interrelationship under certain Experimental Conditions.

D. P. Sadhu, Calcutta.

The relationship that may exist between Thyroid and Adrenal glands have been studied under a wide variety of experimental conditions with about 200 albino rats. Feeding of thiouracil or|and Vitamin A, injection of dinitrophenols or|and thyroxine and their several combinations have been tried. It was found that where the thyroid weight decreased, the weight of the adrenals increased and vice-versa. This interrelationship could not be ascribed to any indirect—effect on metabolism. This interrelationship, however failed under certain toxic conditions and under conditions of stress such as exposure to cold. This inter-relationship may be of interest in the study of tyrosine metabolism since the latter is influenced by the hormones secreted by thyroid and medulla of adrenal gland.

44. Physiological Normals and their Deviations.

J. N. Maitra, Calcutta.

A large number of human subjects have been studied with regards to their physiological functions. In the cardiological series it has been noticed that a simple pain spot may be due to epicritic stimulation or on the other hand due to very serious but early damage to heart, kidney or the liver. A plea has been made for the study of norms after mass radiography, mass encephalography or mass electrocardiography etc.

45. Certain aspects of the Physiology of Pteropus Ciganteus Giganteaus.

K. L. Verghese, Madras.

The body temperature of Pteropus, a fruit bat of the Indian Peninsula was studied by three hourly observations on temperature of this animal for some time. It was found to vary between 95 to 100 deg. F with an average of 98.37°. But when the environmental temperature was raised to 115° the body temperature rose to 107° but when the invironmental temperature was lowered to 40°F the body temperature remained stationary at 98°F. Minor's test and Aubert's test (ref. Yas Kuno) were performed to detect the presence of sweat but the result was negative. By inserting a needle in the carotic artery the B. P. was measured and found to be 100-140 mm Electrocardiograms were also taken for study. Pulse rate was found to be 428-461 and respiratory rate 90-100 per minute. Hæmatological studies were also made of the blood.

46. Post Operative Complications of Cataract Extraction as an Allergic Phenomenon.

S. N. Cooper and B. P. Chakravorti, Bombay.

Some times severe inflammatory reactions have been noticed in the eyes after the operation for cataract. Verhoeff and Lemoine had observed that when such patients were tested with lens protein they were definitely hypersensitive to this material. Further when the subjects were desensitised by injections of lens protein a rapid improvement in the ocular condition followed. This allerigic phenomenon has been studied by the authors. Under the auspices of the I.R.F.A. in K. E. M. Hospital, Bombay. Lens antigen is being prepared from bovince eyes. Rabbits have been found to become hypersensitive to this lens protein. The different fractions of the lens proteins L.B.Y. have been isolated and efforts are being made to produce the respective anti-sera in order to determine which of these three factors is responsible for the antigenic property.

47. An Alterative Method for Stimulatine the Vagus Nerve for Tracing the Contraction of the Heart of Frog.

K. I. VERGHESE, Madras.

In the standard method of demonstrating the effect of vagus stimulation on the heart of frog (from the ventral aspect, vide Experimental Physiology by Harris D. T. 1941, page 54) there is a chance of stimulating the lavyngeal branch of the vagus nerve and the hypoglossal nerve along with the pulmocardiac branch. This will contract the larynx and the lower jaw of the animal and thus spoil the tracing of the cardiac contraction on the kymograph. So another method of exposing the vagus nervе so as to separate the pulmo-cardiac branch alone is explained here.

A cylindrical piece of paper or pith (covered over by black paper) is plugged into the frog as far as the stomach. Then the animal is nailed on its side with the fore-limbs at right angles to the body with its hind limbs crossed over each other. The supra-scapula and the scapula are removed to expose the brachial plexus and the vagus nerve. The plexus is cut off and pulmo-cardiac is separated from other surrounding tissues easily. A hooked electrode is inserted below the pulmo-cardiac branch alone and stimulated. An incision is made from the region of the lungs to the xiphisternum so that the heart can be exposed and apex of the ventricle can be hooked up to the lever for tracing. In this method there is no possibility for getting any other tracing, due to contraction of the various other related organs, as sometimes obtained by the first method. Secondly the pulmo-cardiace branch can be easily identified and separated.

Miscellaneous

48. Improvised Electrode Jelly for use E. C. G.

S. M. BANERJI, AND S. TEJ, Cuttack.

It had happened once that we had run short of the E.C.G. electode jelly tubes and the old ones were gritty and causing awful variation in the base line of our curves. The following composition was found to give as satisfactory results as the manufactured ones and is recommended for trial:—

Ordinary adhesive paste (Malay)
Glycerine a a partes equalies.
NaCl to make 9%

This can be applied by the brush supplied with the adhesive paste phials after the skin has been rubbed clean with absolute alcohol and dried.

49. Effect of Thyroprotein Feeding on the Reproductive Performances in Rats.

D. N. MULLICK, Izatnagar.

24 female rats were devided into two groups, in one group the stock diet was supplemented with 0.02% of thyroprotein and the other group was kept as control. Estrous cycle noted by vaginal smear, was short and the percentages of the successful matings were higher in experimental groups. The body weight gestation period, average number and the weght of the litters were same in both the groups. The addition of thyroprotein can be used in getting more litters in a life cycle in a female rat.

50. Biometric Measurements in Cattle.

D. N. Mullick, Izatnagar.

A study was made on the relationship of the heart girth measurments and the body weight of 153 Hariana cattle, 24 Murrah buffaloes and 38 Hill bulls. These animals were from the Institute dairy and the Nutrition shed, Izatnagar.

The coefficients of correlations between the heart girth and the body weight were 0.959, 0.982 and 0.605 for Hariana cattle, Murrah buffaloes and Hill bulls respectively, all were statistically highly significant.

A calculation of the regression equation on actual live weight and heart girth showed as straight line relationship. It was shown the difference between the observed and calculated live weight and was found that the difference was little.

51. Factors Influencing the Vitamin A Content and the Chemical Constants of Buffalo Ghee.

J. C. Sharma, Izatnagar.

Investigations were made on the influence of the method of preparation, stage of lactation, level of carotene ingestion and season on the vitamin A potency and the chemical constants of buffalo ghee.

The methods of preparation studied appeared to have practically no effect on the vitamin A potency or the chemical constants of buffalo ghee. Although the fat percentage in milk increased, the vitamin A content per gram of fat was found to decrease with progress of lactation. The saponification and the R. M. value showed a tendency to fall with progress of lactation, whereas no regular trend was observed in the case of Iodine and R. P. values.

Increase in the ingestion of carotene appeared to increase the iodine value of ghee. The saponification and R. M. values were slightly lowered whereas no definite trend was exhibited by the R.P. values.

Animals kept under identical conditions of feeding and management showed no marked difference in the output of vitamin A and the chemical composition of butter fat produced from the same buffalo in rainy and winter season.

52. Ascorbic Acid in Plasma and Milk of Bengali Women.

K. K. Bagchi, Calcutta.

Milk and plasma of twentyfive healthy lactating Bengali Women were analysed for Ascorbic Acid content. The subjects were selected from the 1st. to 7th month of lactation at which latter period the baby is usually weaned. The babies of these experimental subjects were quite healthy and thrived entirely on breast milk.

Ascorbic acid in milk varied from 4.9 mgm per 100 c.c. to 8.6 mgm. per 100 c.c., the average being 6.7 mgm. per 100 c.c. The plasma ascorbic acid varied from 0.6 mgm. to 0.98 mgm. per 100 c.c., the average being 0.77 mgm. There was a consistent relationship between the ascorbic acid value of plasma and milk, the average ratio being 1 :8.6.

Judging from the ascorbic acid value of milk, it can be safely declared that supplement of ascorbic acid to breast fed baby is not at all essential, if ofcourse the diet of the mother is adequate. For example a five month baby will get 48 mgm. of ascorbic acid daily from mother's milk, whereas the requirement is 30 mgm. only. (Recommendation of National Research Council of U.S.A.—1948)

53. Riboflavin Content of Dired Silk Worm.

A. K. GHOSH, K. RAJAGOPAL, and G. R. AMRITMAHAL, Calcutta.

It was observed by Dr. A. C. Chatterji (Formerly Director of Health Services, Government of West Bengal) that in Japan the school children in poor Districts were given dried silkworm powder as a 'tonic' and the general appearence of the children was very good. After the worm is used for making silk the rejected part is dried and can be crushed into a powder. Protein content of the dried worm has been reported in the literature. No figures are available for riboflavin.

A sample of dried silkworm (Bomb Mori), after the sik was extracted, was obtained from a Silk Factory in West Bengal, through the courtesy of Dr. Chatterji. Microbiological method of assay using lactobacillies Caseii (American type culture collections, Number 7469) as the test organism was adopted. Methods of extraction, sampling, preparation of standard and sample tubes and inoculation were the same as recommended by A.O.A.C. Growth of organisms after 72 hours incubation was measured by acidimetric titration using Cambridge pH metre. The results were as follows:—

Trials	gamma riboflavin per gram of sample
1.	64.0
2.	64.8
3	64 5
4.	64.5

30 gamma of riboflavin added to the extract of the sample and three trials for recovery of the added amount were made; it was found that 97.0 to 97.3% were recoverable.

It is therefore established that dried silkworm (a by-product in Silk industry) is a very rich source of riboflavin.

54. Thiamine and P2O5 Content of Rice.

K. K. BAGCHI and K. RAJAGOPAL, Calcutta.

Fifteen different samples of rice, as available in the local market were analysed for the thiamin content.

Phosphorus content (as P2O5) was also determined to find out whether any correlation exists between U2O5 and the thiamine figures.

Sample number	Thiamine V|Gm.	P2O5 Gm%	Sample number	Thiamine V|Gm.	P2O5 Gm%	Sample number	Thiamine V|Gm.	P2O5 Gm%
1	1.3	0.58	6	1.2	0.27	11	1.0	0.5
2	1.8	0.41	7	2.2	0.5	12	0.75	0.2
3	1.6	0.55	8	1.0	0.46	13	1.5	0.41
4	1.0	0.56	9	0.75	0.32	14	2.06	0.46
5	1.5	0.46	10	1.0	0.48	15	1.72	0.38

From the above table, it can be seen there is no correlation between the thiamine and P_2O_5 figures.

This can possibly be explained by the fact, that the scutellum of the rice grain, like that of wheat, is very high in thiamine content. In parboiled rice, the scutellum becomes very tough and even by milling, it is not removed. This fact was also verified by observing the germ site by a magnifying glass. The depression there in raw milled rice is concave while that in parboiled milled rice is almost flat. In milling of parboiled rice, much of the phosphorus content is removed, whereas proportionately thiamine is not removed.

55. Studies on Venezuela (Melinis Minuliflora, Beav) Grasses. Part II—Digestibility and Nutritive Value of Venezuela Grass Hay.

Barua, J. N., Ayyar, N. K., & Kehar, N. D., Izatnagar.

Feeding trials with Venezuela hay cut at two different stages of growth conducted on local bred adult sheep showed that the animals consumed proportionately a large amount of hay cut at the pre-flowering stage than at the flowering stage. This may be due to higher palatability of the grass owing to the leafy nature of the herbage.

The results of the metabolic trials show that the animals can make better utilization of the nutrients from Venezuela hay made from the pre-flowering stage than from flowering stage.

All the animals in both the experiments recorded positive balances of Nitrogen, Calcium and Phosphorus. The retentions of these elements in the pre-flowering stage were found to be appreciably higher than those of the flowering stage.

Hay made at the preflowering stage shows a better nutritive value than at the flowering stage.

37th INDIAN SCIENCE CONGRESS, POONA 1950

SECTION OF CHEMISTRY

PRESIDENT : DR. J. K. CHOWDHURY, Ph.D.

Abstracts

Inorganic Chemistry

1. Condition of Sparingly Soluble Salts of Copper and Silver in Gelatin.

A. C. CHATTERJEE *and* M. C. RASTOGI, Lucknow.

The condition of varous sparingly soluble salts of silver and copper in gelatin at various concentrations was measured and the percentage of cations of the respective salts was calculated. The percentage of ions in salts like ferrocyanide, ferricyanide, thiosulphate of silver and ferrocyanide, ferricyanide, borate, hydroxide and arsenate of copper varied between 0.0023 and 2.714, while in the rase of silver iodate it is about ten times the solubility. The low percentage appears to indicate that the sparingly soluble substance is not in the ionic condition as is required for supersaturation, but is in the colloidal state Further work is in progress in this laboratory, with a view to extend the investigation to a large number of sparingly soluble salts to elucidate the true cause of the phenomenon namely that the salts like silver chromate, lead iodide, silver iodate indicate a large percentage of the salt in the ionic condition as compared to the other salts which appear to be in the colloidal state.

2. Formation of Complex Compounds Between Lead Nitrate and Alkali Nitrates.—Part XI.

(*Transport Number Measurements*)

The Systems : a) $LiNO_3$-Pb (NO_3) 2-H_2O
b) $RbNO_3$-Pb (NO_3) 2-H_2O

M. R. NAYAR *and* C. S. PANDE, Lucknow.

In previous communications (Proc. Ind. Sci. Cong. Abst., 1949, *4*, 42-43) it has been shown that three definite complexes are produced in solution in the system : $RbNO_3$-Pb (NO_3) 2-H_2O, while no such formation could be detected in the system $LiNO_3$-Pb-(NO_3) 2-H_2O. In order to have an additional confirmation and also to have quantitatively comparable idea of the behaviour of $LiNO_3$ and $RbNO_3$, experiments on transport number of Pb ion were carried out.

The method adopted was the same as described in (Proc. Ind. Acad. Sci., A, 1948, *27*, 354-60). From the results obtained it is obvious that the percentage diminution in the transport number of Pb ion in the presence of $LiNO_3$ is of a very low order as compared with those in the case of KNO_3 & NH_4NO_3 systems. It is even less that that observed in the case of $NaNO_3$ system. In the case of KNO_3 & NH_4NO_3 systems the percentage change varied from 35% to 72% while even in $NaNO_3$ system the maximum was 18%. But in $LiNO_3$ system the maximum percentage change was only 7%. This means that the tendency for the formation of complex compounds in $LiNo_3$ is even less than system that in the case of $NaNO_3$.

On the other hand in $RbNO_3$ system, the percentage change effected in transport number of Pb ion was 38% to 75%, which is even slightly more than that observed in the case of KNO_3 system. This clearly indicates that the tendency for the formation of complex compounds in $RbNO_3$ system is even more that in the case of KNO_3 system.

Thus we find the formation of complex compounds between lead nitrate and alkali nitrates seems to be conditioned by the order of alkali metals in the Periodic Table.

3. Physico-Chemical Investigations on the Complex Formation between Pyrophosphate Ion and Beryllium Ion in Solution.

B. C. HALDER, Calcutta.

The author has studied the complex formation between pyrophosphate ion and beryllium ion in solution by different physico-chemical methods such as transport, thermometric, conductometric, P_H-measurements and cryoscopy in saturated sodium sulphate solutions. It has been proved conclusively that in solution containing excess of alkali pyrophosphate and beryllium salt, anionic complexions having beryllium in the anion are present. The complex ions are of the type $[Be(P_2O_7)]^{-2}$ and $[Be(P_2O_7)_2]^{-6}$ and are found to exist in simple monomeric form. In presence of excess of pyrophosphate ion, the complex formation may be represented in a step-wise manner as follows:

$$Be^{+2} + P_2O_7^{-4} \leftrightarrows [Be(P_2O_7)]^{-2}$$

$$[Be(P_2O_7)^{-2} - P_2O_7^{-4} = [Be(P_2O_7)_2]^{-6}$$

4. Formation and Stability of Cobaltic Biguanide Complexes.

PRIYADARANJAN RAY *and* ANIL KUMAR DEY, Calcutta.

Cobaltic tris-biguandie and tris-phenylbiguanide complexes have been found to dissociate by stages as tris ⟶ bis ⟶ monobiguandie complex ⟶ Co^{+++} in solution. Reversibly their formation also occurs in a similar manner by successive stages. The instability constant for each of these individual complexes— the co-ordinatively saturated and partially saturated ones— has been determined from a study of the equilibrium constants of the reactions between the complex ions and hydrogen ion, which occur as :

$$[Co(BigH)_3]^{+++} + H^+ \longleftrightarrow [Co(BigH)_2]^{+++} + BigH_2^+$$

$$[Co(BigH)_2]^{+++} + H^+ \longleftrightarrow [Co(BigH)]^{+++} + BioH_2^+$$

$$[ffo(Bigh)]^{+++} + H^+ \longleftrightarrow [Co]^{+++} + BigH_2^+$$

where BigH = a molecule of biguanide or phenylbiguanide, that is equal to $C_2N_5H_7$ or $C_3N_5H_6Ph$.

The individual equilibrium constants, k'_3, k'_2 and k'_1, were obtained from p_H measure ment of solutions to which known amounts of acid were added and from the E.M.F. measurement in presence of cobaltous ions for the Co^{+++} — Co^{++} system.

Similarly, the dissociation or the formation of individual complex ion can be represented by the equations :

$$[Co(BigH)_3]^{+++} \longleftrightarrow [Co(BigH)_2]^{+++} + BigH^+$$

$$[Co(BigH)_2]^{+++} \longleftrightarrow [Co(BigH)]^{+++} + BigH^+$$

$$[Co(BigH)]^{+++} \longleftrightarrow [Co]^{+++} + BigH^+$$

while the corresponding instability constants are denoted by k_3, k_2, and k_1 respectively.

The first and the second acid dissociation constants, $k_1{}^*$ and $k_2{}^*$ of biguanide, correspond to the equations :

$BigH_2^+ \longleftrightarrow BigH + H^+$ and $BigH_3^{++} \longleftrightarrow BigH_2^+ + H^+$. These were also determined from pH measurements.

The instability constants, k_3, k_2 and k_1, were then clculated by the relation,

$$k_3 = k'_3 k_1{}^*, \quad k_2 = k'_2 k_1{}^* \quad \text{and} \quad k_1 = k'_1 k_1{}^*.$$

The overall instability constant K is then equal to $k_3 . k_2 . k_1$ or $K . k_1{}^{*3}$, where $K' =$ overall equilibrium constant $= k'_3 . k'_2 . k'_1$.

The overall instability constant K for cobaltic tris-biguanide and cobalitic tris-phenylbiguanide complexes have been found to be equal to 7.3×10^{-50} and 2.7×10^{-55} respectively. These are much smaller than the instability constants for cobaltammines as determined by Lamb and Larson (J.A.C.S., 1920, *42*, 2024), who found for the hexammine cobaltic complex a value of 2.2×10^{-34} only. This is in perfect agreement with the nature of the biguanide complexes as salts of the inner metallic type, which, as is well known, represent the most stable class of co-ordination complexes. It will be observed further that phenylbiguanide gives rise to a somewhat more stable complex than the simple biguanide.

5. Studies in Niobium and Tantalum Part V Tartratoniobates of Copper and Lead.

N. R. Srinivasan, Bangalore.

The tartrato complexes of niobium with the alkali and alkaline earth metals have been described previously (Srinivasan, Proc. Indi. Sci. Cong, 1948, Sec 4, p.5; 1949, Sec 4, p.98). The copper and lead compounds were prepared by double decomposition of a soluble salt of the metal with potassium tartratoniobate. A pale green copper tartratoniobate and a white lead tartratoniobate, were obtained. Analysis revealed the composition as

$$CuO.\ Nb_2O_5(C_4H_4O_5)_2\ 10H_2O \text{ and}$$
$$5\ PbO.\ 3Nb_2O_5(C_4H_4O_5)_6\ 20H_2O.$$

On the analogy of the barium compound, the lead salt was formulated as a basic compound. The properties of the compounds were studied.

6. Studies in Niobium and Tantalum.—Part VI. Dehydration of Tartratoniobates.

N. R. Srinivasan, Bangalore.

The compounds obtained in these studies were dehydrated in air and in vacuum to find out the loss in water by the substances at different stages. Dehydration in air was carried out by heating the substances to constant weight in an air oven maintained at different temperatures to a maximum of 135°C. Dehydration in vacuum was conducted in a specially designed apparatus which could also be used for measuring the vapour pressure of compounds. It has been found that some molecules of water are loosely bound and hence easily removed whereas there are other molecules which are more firmly bound and only removable with considerable difficulty. On this basis suitable structures have given been to the various compounds. The vapour pressure of the hydrates have been determined at 26°C. Isothermal dehydration of the higher hydrate in the case of the alkali tartratoniobates, revealed the absence of definite intermediate hydrates.

7. Studies in Niobium and Tantalum.—Part VII. Solubility Determinations

N. R. Srinivasan, Bangalore.

Studies on the solubilities of tartratoniobates were made in water, water-alcohol mixtures and tartaric acid solutions of different concentrations. The alkali salts were moderately soluble in cold water and highly soluble in hot water. They were insoluble in alcohol. Their aqueous solutions became easily superaturated and supersaturation was not released by freezing and introduction of nucleii, which explained the difficulties encountered in crystallisation. Further the time of contact of the solute with the solution influenced the quantity of the substance dissolved upto a maximum and with long periods, the solutions tended to become collodial as was demonstrated by the Tyndall effect. Adequate explanations have been offered for the abnormalities met with in solubility equilibria.

8. Studies in Niobium and Tantalum.—Part VIII. Degradation Studies.

N. R. Srinivasan, Bangalore.

It was observed that the alkali tartratoniobates, exemplified by the general formula R_2O, $Nb_2O.\ (C_4H_4O_5)_2\ nH_2O$ (R=Alkalimetal) (N=Variable number), decompose in aqueous solution on vigorous and continued boiling, throwing out tartaric acid and resulting in newer compounds. Quantitative studies have been conducted on the hydrolytic decomposition and the amount of tartaric acid formed. Reconversion to their original compounds seems impossible. These compounds have been separated and their identity and individuality as a new class of compounds, established by chemical analysis, microscopic examination of crystals and other tests. The following compounds have been prepared and studied :

$$2\ K_2O.\ 2\ Nb_2O5.\ (C_4H_4O5)_3.\ 13\ H_2O.$$
$$2\ Na_2O.\ 2\ Nb_2O5.\ (C_4H_4O5)_3.\ 13\ H_2O.$$
$$2\ (NH_4)_2O.\ 2\ Nb_2O5.\ (C_4H_4O5)_3.\ 12\ H_2O.$$

9. 5-chloro-8-Hydroxyquinoline as an Analytical Reagent.—Part. I. Estimation of Magnesium.

M. K. **Bose**, Calcutta.

A method for the estimation of small quantities of magnesium on the Spekker photoabsorptiometer, after precipitation of the metal with reagent is described.

10. Estimation of Mercurous Ions by Precipitation Method using Adsorption Indicators.

R. C. **Mehrotra**, Allahabad.

Tetraiodophenol sulphonphthalein has been described as a very suitable adsorption indicator for the titrations of chloride and bromide ions against mercurous ions. The new indicator gives sharper end points than the most suitable indicator so far described 'bromophenol blue' (Kolthoff and Larson, J. Am. Chem. Soc., *56*, 1881, 1934). It not only gives sharper colour change than any other indicator so far described, but also makes the titration possible in much larger concentrations of the acids. The end points in the reverse titration of mercurous ions by chloride and bromide ions also is sharper with the new indicator than with any of the previously described indicators. Similar to earlier observation (Mehrotra, Anal. Chem. Acta, *3*, 78, 1949), it has been shown that the forces between mercurous ions and the dye are chemical in nature and it is probably a case of surface compound formation.

11. Argentometric Titrations of Thiocyanate Ions Using Adsorption Indicators.

R. C. **Mehrotra**, Allahabad.

In a recent communication (Mehrotra, Anal. Chim. Acta, *3*, 69, 1949), bromophenol blue has been shown to be a very good indicator for the titration of thiocyanate ions against silver ions. It can be used upto a dilution of N/250 of the titrating solutions and even when the pH of the solution is as low as 3. The present communication describes a comparative behaviour of a number of new adsorption indicators—dichlorofluorescein, dibromofluorescein, nitrazine yellow, bromocresol green, chlorophenol red and tetraiodophenol sulphonphthalein—in the above titration. Tetraiodophenol sulphonphthalein has been shwn to be a very useful indicator and is found to be applicable at a pH as low as 2 and givs well defined and very sharp end points for dilutions as low as N/500.

12. Analysis of a Mixture of Cu, Cu_2O, and CuO.

S. M. **Mehta** *and* N. R. **Bharucha**.

No satisfactory method for the determination of Copper, Cuprous oxide and Cupric oxide in a mixture is known. The present method consists in extracting Cu_2O from the mixture by means of a hot saturated solution of KI. The Copper and Cupric oxide left over are dissolved in acidified ferric chloride solution and the resulting Ferrous iron titrated against standard $K_2Cu_2O_7$ using barium diphenylamine sulphonate as the internal indicator. The Copper in the mixture is thus determined. To determine Cu_2O in the mixture, the sample is treated with acidified ferric chloride solution and titrated against $K_2Cr_2O_7$ as mentioned previously. The amount of Cu_2O in the sample is obtained by substracting the number of ccs. required in this tisation from the number of ccs. required in the previous titration. For determining CuO in the mixture, the sample is dissolved in the minimum quantity of concentrated HNO_3 and the total coppe content determined iodimetrically. Knowing total copper, metallic copper and cuprous oxide, CuO can be calculated.

13. Studies of a Sample of Lepidolite from Bastar District, C.P.

R. K. **Dutta Roy**, P. K. **Chatterjee** *and* B. N. **Sen**, Calcutta.

Lepidolite is known to contain lithium, rubidium and caesium in small quantities along with soda and potash. Other minerals containing the above elements are triphylite, lithophyllite spodumene, amblygonite, petalite etc.

The occurrence of lepodilite in India is very much limited, the only important deposit being in Bastar State (now district) C.P. There are two separate deposits occurring as pegmatites one being about 400 yds. south of Mundaval (18°39′ : 81°56′) and the other one at a distance of near about 600 yds. in the SW. of this village. The materials obtained from these two occurrences are of massive nature and of lilac colour with pearly lustre. A representative sample of this mineral was chemically analysed and the Li_2O content was found to be 2.56%. Besides chemical analysis the mineral was subjected to spectroscopic examination and from the spectrograms it was found to contain a fair amount of rubidium and probably a little of caesium.

14. Estimation of Metallic Phosphides and Phosphine.

D. D. KARVE, K. K. DOLE, M. G. BADAVE, Poona.

Different methods of estimating phosphine have been compared and a new method of determination and quantitative estimation has been developed. Metallic phosphides are decomposed by dilute acids and the resultant phosphine is absorbed in a dilute solution of silver nitrate. The reaction between phosphine and the silver nitrate runs as follows :

$$8\,AgNO_3 + PH_3 + 4_2H\,O = H_3PO_4 + 8\,Ag + 8\,HNO_3.$$

Silver is precipitated as a brownish black precipitate and is then dissolved in nitric acid and estimated as silver nitrate by a standard potassium thiocyanate solution. Phosphine and the phosphides can be estimated accurately and even small amounts of phosphides can be determined by the method.

15. Reduction of Phosphates by Alumino-Thermic Reaction.

D. D. KARVE, K. K. DOLE, M. G. BADAVE, Poona.

In continuation of the work of reduction of sulphates the study of reduction of phosphates has been carried out. The reaction is complicated, primary, secondary, tertiary, simultaneous and consecutive reactions seem to take place. One of the important reaction products is the phosphide. The formation of the phosphide depends on the quantity of aluminium employed and the temperature that is attained during the course of the reaction. The larger the quantity of the aluminium used, the larger is the phosphide formed and the higher the temperature attained in the reaction the lower is the yield of phosphide. It seems that the reduction depends upon the following factors: (i) the cation of the phosphate, (ii) percentage of the aluminium used, and (iii) particle size of the reactants. Phosphates of the alkali metals and the alkaline earth metals do not react under the existing experimental conditions.

16. Reduction of Chromates, Borates and Allied Compounds by Alumino Thermic Reaction.

K. K. DOLE, M. W. NENE. Poona.

In continuation of the work of reduction of sulphates and phosphates, the study of chromates. borates and allied compounds has been made in this paper. Heavy metal chromates are easilly reduced to metallic condition and the metals vapourize at the high temperatures of the reaction. The reactions are followed by chemical analysis, measurement of temperature of the reaction and propagation of flame through the reaction mixture. As is expected chromates react vigourously and the temperatures as high as 3400°C. are quickly obtained. Borates exhibit very slow reactions and the rate of propogation of flame in the reaction mixture is also slow. It seems that the velocity of propagation of flame through the reaction mixture would be proportional to the reaction velocity itself.

17. Investigations on the Extraction of Potash from Felspar.

ESWAR RAJ SAXENA, D. S. DATAR *and* S. HUSAIN ZAHEER,
Hyderabad—Deccan.

Besides the method of digestion of felspar with lime under pressure, the other reactions which have been investigated in these laboratories for the extraction of potash from felspar are:—

(1) The digestion of felspar with sulphuric acid of different concentrations and
(2) Heating of felspar with calcium carbonate and calcium chloride.

While by the former method the yield of potash is poor viz., 3.4% irrespective of the concentration of sulphuric acid employed, that by the latter is about 60%.

18. Mechanism of the Reactions of Felspar with Calcium Oxide and Calcium Nitrate.

ESHWAR RAJ SAXENA, D. S. DATAR *and* S. HUSAIN ZAHEER, Hyderabad—Deccan.

The method suggested for the extraction of Potash from Felspar consists of digestion of this potash bearing mineral with lime or basic calcium nitrate under pressure. This method has been investigated in these laboratories.

The results show that the yield of Potash is directly proportional to the period of digestion and proportional to the square root of the digestion pressure.

Tentative equations to represent the reactions between Felspar and calcium oxide and also basic calcium nitrate have been given.

The process can be commercialized if valuable bye-products are obtained such as white cement which can be obtained from sludge if iron free lime is used for digestion.

Physical Chemistry

19. Silver Thio-Cyanate Electrodes.

R. K. PARIDA, S. ADITYA *and* B. PRASAD, Cuttack.

The similarity in the behaviour of the Thio-cyanate ions with halogens and the solubility of AgCNS lying between that of AgCl and AgBr led us to attempt the preparation of the thio-cyanate electrodes. Ordinary method of depositing AgCNS by electrolysis on Ag foil did not prove satisfactory. Spongy Ag was formed on Ag surface deposited electrolytically on platinum helix. On this AgCNS was deposited at 1 m/amp for 6 hours from 0.75 M NH_4CNS or KCNS soln. This serves very well for the purpose of titration of CNS with Ag. Even the presence of other salts such as NH_4 NO_3 does not shift the break. KCl also has no effect. The break occurs as usual but if it is followed further second break corresponding to it also occurs. The error in comparison with ordinary volumetric method is not more than 1%.

20. Reduction Processes at the Dropping Mercury Electrode in Pulsating Fields.

K. S. GURURAJA DOSS *and* H. P. AGARWAL, Kanpur.

The work of Breyer and Gutmann on the effect of superimposing alternating fields on the reduction processes occuring at the dropping mercury electrode, has been extended to lead solutions. The work has been done at different frequencies of the alternating field. All the results obtained are interpretable on the basis of the diminution in the capacitative impedence of the dropping electrode as the half wave potential is approached as well as when the froquency of the alternating field increases. These results are largely confirmed by direct observations on phase shifts by means of the oscillograph.

21. Role of Indifferent Electrolytes in Electrode Kinetics.

K. S. GURURAJA *and* H. P. AGARWAL, Kanpur.

By studying the Kinetics of the electrode processes Randles observed that the rate constant for the discharge for the Zinc ion depended upon the nature of the indifferent electrolyte used in the experiment. It is shown that the variation in the rate constants can be interpreted plausibly on the basis of the variation of the Equilibrium potential of the different systems.

22. Ash Percentage in Indian Final Molasses from Electrical Conductivity Measurements at 35°C.

K. S. G. Doss *and* K. K. Gupta, Kanpur.

Thirtysix samples of molasses drawn from all over India were analysed for soluble ash and electrical conductivity. Equations have been worked out for correlating the ash content with two, three and four conductance measurements. The three conductance methods are slightly better than the two conductance method. The method involving the use of phosphoric acid is found to yield better correlaton than that using hydrochloric acid. The four conductance method is self defeating as it means experi: mental complications without any gain of accuracy.

23. Theory of Ash Determination by Three Conductance Measurements

K. S. G. Doss *and* K. K. Gupta, Kanpur.

A theoretical equation has been derived for the determination of ash by three conductance measurements. It is shown that the theoretical equation is equivalent to the equation derived for Indian molasses. The apparent opposite sign appearing with the term K_2 is the equation for Indian molasses as compared to the theoretical one has been explained. It is shown that the group C ash forming constituent are not of much importance in Indian Molasses.

24. Dissociation of Lead Nitrate in Aqueous Solution.

S. Nath, S. Aditya *and* B. Prasad, Cuttack.

It has been suggested by Davies that Lead Nitrate dissociates in two stages, that the first stage of dissociation $(Pb\,(NO_3)_2 \rightarrow Pb(NO_3)^+\ NO_3$ corresponds to that of strong electrolyte and that the second stage of dissociation $PbNO^+_3 \rightleftarrows Pb^{++} + NO^-_3$ to that of a weak electrolyte. Davies has measured the dissociation constant of the second stage of dissociation from conductivity data by making some approximations and finds it to be $6.47 \times 10^{\,2}$. The results of Davies were checked by studying the e.m.f. of two kinds of cells.

$$Pb_x\,Hg_y\left|\begin{array}{c}Pb\,(No_3)_2\\ C_1\end{array}\right.\begin{array}{c}\text{Satd}\\ |NH_4\,No_3|\end{array}\left|\begin{array}{c}Pb(No_3)_2\\ C_2\end{array}\right|Pb_x\,Hg_y.$$

and

$$Pb_x\,Hg_y\left|\begin{array}{c}Pb\,(No_3)_2\\ C_1\end{array}\right|\begin{array}{c}Pb\,(No_3)_2\\ C_2\end{array}\left|Pb_x\,Hg_y.\right.$$

The liquid junction potential in the first kind of cells was estimated not to exceed 1 mill, volt. The e.m.f. of the first type of cell could be calculated on the basis of the assumptions that

1. liquid junction potential was negligible
2. Activity coeficient of Pb in lead nitrate solution could be calculated from the knowledge of the activity coeficient of $Pb\,(NO_3)_2$, KNO_3 and KCl at the same ionic strengths. The calculated e.m.f. agree with the measured results within experimental errors.

The e.m.f. of the second type of the cell is given by the formula

$$E = t\,\frac{3RT}{2F}\ln\frac{a_1\,Pb\,(No_3)_2}{a_2\,Pb\,(No_3)_2}$$

activity coefficient of $Pb\,(NO_3)_2$ which is required can be got from the Landolt's Tables. The e.m.f. could therefore be calculated if the transport number is known. Alternately the transport number itself can be calculated. We calcuated the transport number and found that it did not vary appreciably with concentration. If lead nitrate was dissociating in two stages the transport number would not have been constant but would have changed as it does in cadmium iodide. Hence from this evidence also $Pb\,(NO_3)_2$ seems to be completly dissociated.

25. Kinetics of Reactions in Liquid-Liquid Heterogeneous Systems.

K. K. DOLE, G. G. MAJUMDAR *and* M. D. BHATWADEKAR, Poona.

Reaction: *Sodium Thiosulphate—Iodine.*

Reaction between aqueous sodium thiosulphate and iodine dissoved in monchlorbenzene is studied as liquid-liquid heterogeneous reaction. It is found that the reaction is diffusion dominated. The temperature coefficient has the value 1.2 when iodine is in excess and 1.0 when sodium thiosulphate is in excess. The rate of diffusion seems to increase with increase in the concentration of iodine, while it remains unaltered on changing the concentration of sodium thiosulphate. When sodium thiosulphate is in excess the bimolecular formula is applicable.

26. Kinetics of Reactions in Liquid-Liquid Heterogeneous Systems Reaction: Sodium Arsenite—Iodine.

K. K. DOLE, G. G. MAJUMDAR *and* M. D. BHATWADEKAR, Poona.

Oxidation of sodium arsenite to sodium arsenate by iodine is studied in heterogeneous system by dissolving sodium arsenite in water and iodine in monochlorbenzene. The reaction was carried out with a constant surface of contact of the liquid phases while the two layers were slowly stirred so as to ensure good diffusion. The reaction had to be carried out in presence of an alkaline medium in order to remove the hydriodic acid formed in the reaction. Small quantities of sodium bicarbonate were added for this purpose. This reaction is also a diffusion dominated one, with a temperature oefficient of about 1.2. It was however found that the temperature did not change even though the nature of the reaction changed from uni-to bimolecular state by changing the concentration of the reactants.

27. Kinetics of Amide hydrolysis.

V. V. WAKADE, G. G. MAJUMDAR *and* D. D. KARVE, Poona.

In continuation of the previous work (Proc. Ind. Sc. Cong., 1949, Part III, p. 76) hydrolysis of Acetamide and Propionamide has been further investigated in Formic Acid, Methyl Alcohol and N-Propyl Alcohol as solvents. The results obtained indicate that the peculiar behaviour of amides towards acid hydrolysis cannot be attributed to only one of the several factors suggested by the previous workers, such as the amide-imide tautomerism, acidity of the reaction mixture, activity of water etc. but to two or more of these factors.

28. Kinetics of Colour Development in Invert Sugar Solution.—Part II.

K. S. G. DOSS *and* S. K. GHOSH, Kanpur.

In an earlier work the Kinetics of colour development in invert sugar solutions of P_H 7 and at 98° C was investigated. In the present work the study has been extended to reactions in an alkaline medium (P_H 11.5) and at ordinary temperatures (28.5°C, 30.0°C, 38.4°C and 41.4°C).

The results show:—

(i) That the rate of colour development in an alkaline medium (P_H 11.5) and at the aforesaid temperatures is proportional to time.

(ii) That with a small increase in temperature the rate of colour development inceseases remarkably.

(iii) That doubling the concentration of invert sugar in the reation mixtures nearly doubles the rate of colour development.

29. The Effect of Various Groups and Ring Complexes on Carbon-Tetrahedral Angle Dissociation Constants of Substituted Glutaric and Adipic Acids

L. D. TEWARI *and* J. D. TEWARI.

A comparative study of the dissociation constants of substituted glutaric and adipic acids has been made with the idea of determining the effect of various groups and ring complexes on carbon tetrahedral angle. The dissociation constants value of cyclohexane-1-acetic-1-propionic acid indicate that cyclohexane ring in it has been stabilised into either of its strainless forms in the unsymmetrical structure obtained by attaching cylohexane residue to the βcarbon atom of the simple adipic acid. The similarity which existed between the values of the dissociation constant of dethyl glutaric acid (33.9) and cyclohexane-1-1-diacetic acid (33.4) can in no case be observed between the dissociation constants $\beta\beta$-diethyl adipic acid (163.8) and cyclohexane-1-acetic-1-propionic acid (41.6).

30. Magnetic Study of Inorganic Compounds of Trivalent Arsenic, Antimony and Bismuth and some Organometallic Compounds of Arsenic

MATA PRASAD *and* L. N. MULAY, Bombay.

The magnetic susecptibilities of several chemically pure inorganic compounds of trivalent. As, Sb and Bi have been measured on a modified form of Gouy's balance. The molecular susceptibilities of compounds of these metals in combination with an anion are a linear function of the number of electrons in the cation. The susceptibilities of $As,^{+3}$ Sb^{+3}, Bi^{+3} have been calculated from these graphs. The mean values obtained being $\chi As^{+3} = -15.60 \times 10^{-6}$, $\chi Sb^{+3} = - 24.96 \times 10^{-6}$, $\chi Bi^{+3} = - 41.6$ 10^{-6}.

Ikenmeyer's relation does not hold for the compounds of these metals. The graphs obtained by plotting the molecular susceptibilities of compounds of each of these metals against the total number of electrons give patterns which are strikingly similar. This indicates that the magnetic behaviour of these chemically related elements is also similar.

The magnetic susceptibilities of several organometallic compounds of arsenic have been measured. The susceptibility of trivalent arsenic has been computed from the molecular susceptibilities of some arsines of the type (R_3 As) using Pascals' corrected constants; the mean value obtained being $-19.77 \times {}^{-}10^{6}$. Further investigation on compounds like the aryl and alkyl arsinic acids [R. As O $(OH)_2$], derivatives of arsenobenzene (R. As = As — R) and others is in progress.

31. Magnetic Susceptibility of the CH_2 Group in Different Homologous Series.

MATA PRASAD, S. S. DHARMATTI, D. D. KHANOLKAR *and*
S. P. WALVEKAR.

The susceptibilities of a number of monobasic aliphatic fatty acids belonging to a homologous series and their alkali and alkaline earth salts were determined on the modified form of Gouy's balance. From the results obtained, the susceptibility of CH_2 group has been calculated for each series.

It has been found that the value of χ CH_2 is constant for a given series of acids and their salts but is different for different series.

32. Diamagnetic Susceptibility of Ammonium Ion.

MATA PRASAD, S. S. DHARMATTI, C. R. KANEKAR *and* M. G. DATAR,
Bombay.

Magnetic susceptibilities of a number of ammonium salts of inorganic acids have been measured on the modified form of Guoy's balance. From the experimental data, the susceptibility of ammonium ion has been calculated by the method of average; this value is definitely lower than those reported in the literature.

The graph obtained by plotting the molar susceptibilities of ammonium salts against the total nuclear charge in the molecule, is definitely non-linear. This graph is very similar to those for the corresponding salts of the alkali metals. This indicates that the magnetic behaviour of ammonium ion is similar to that of the alkali ions.

A linear relation has been found to hold between the molar susceptibilities of salts of Li, NH_4 and K containing a common anion and the number of electrons in the cations. This relation has been used to calculate the susceptibility of the ammonium ion in combination with different anions.

33. Magnetic Susceptibilities of Hydrates of Boron Compounds.

MATA PRASAD, C. R. KANEKAR *and* (MISS) L. S. KAMAT, Bombay.

Susceptibilities of a number of hydrates of different polyborates were measured on the modified form of Gòuy's balance. The observed data of molar susceptibilities has been compared with the values calculated for the hydrates from the anhydrous salts on the basis of strict additivity. In the case of several hydrates of each polyborate, the deviation ($\Delta\chi_m$) of the observed susceptibilities of the hydrates from the calculated values increases steadily though not uniformly as the number of water molecules (n) in the hydrates increases. The deviation per molecule of water of crystallisation $\left(\frac{\Delta\chi_m}{n}\right)$,however, decreases steadily as n increases. These deviations are probably due to the deformation caused by the water molecules as a result of binding with the cat—and anions in the hydrates.

The susceptibilities of water molecules when bound chemically to an anion are greater than that of water molecule attached electrostatically to a cation. Further, the contribution of susceptibility per mole of water of crystallisation attached to an anion is constant for several hydrates in which the water of crystallisation is attached to the anion.

34. Magnetic Study of Some Boron Compounds.

MATA PRASAD, C. R. KANEKAR *and* (MISS) L. S. KAMAT, Bombay.

A number of compounds containing boron were prepared in a pure condion and their susceptibilities were measured on a modified form of Guoy's balance. Values for the susceptibilities of anions containing boron wers calculated by the method of averages. The average susceptibility values of the meta, tetra and penta borate ions are a linear function of the number of electrons in the ions. Values calculated for the susceptibility of tetra and penta borate ions by using the average values of the meta borate ion and the observed susceptibility of B_2O_3 are higher than the observed values of the tetra and penta borate ions. From the difference between the two values the extent of the depression resulting from the binding between each molecule of B_2O_3 and the meta borate ion to form the tetra borate and penta borate ions, is found to be constant for both the ions. This substantiates the view that there is a chemical relationship of the penta and tetra borate ion with the meta borate ion. The examination of the constitution of the hydrated decaborate ion in a similar way indicates that it is more closely related to the BO_2'' ion than to the BO_2' ion.

On plotting the molecular susceptibilities of the decaborates of Ca, Sr, and Ba against the number of electrons in the cation, a straight line is obtained. This linear relation has been used to calculate the susceptibility of the decaborate ion and the alkaline

35. Resonating Semipolar Single Bond. Part V. Interpretation in Terms of Wave Mechanics and Other Theories

SAIYID SHAMIM-AHMAD, Aligarh.

The idea of semipolarisation of single bond put forward earlier (Proc. Ind. Sci. Cong., 1948, Chem. Sec. Abst. No. 19) is explained in greater detail and shown to be different from Prideaux, Ingold and Sugden's formulation in that resonance is also assumed to be present between the half charges characteristic of the semipolar single bond if the two atoms are of strong and about equal electron polarising nature. IN ORDER TO DIFFRENTIATE THE PRESENT VIEW FROM EARLIER IDEAS AND TO AVOID CONFUSION, THE TITLE OF THESE SERIES OF PAPERS IS CHANGED TO 'RESONATING SEMIPOLAR SINGLE BOND' IN PLACE OF 'SEMIPOLAR SINGLE BOND.'

The picture in terms of wave mechanical theory and the theory of electron as resonators is given to explain the colour present in most of the resonating semipolar single bond compounds e.g. Cl_2, NI_3, HOCl etc. The same idea is shown to explain the weakness of 0-0, N-N bonds as also the almost constant distance between O-O, N-N and F-F despite the increasing nuclear charge. The change in colour of iodine solutions, the anomalous dipole moment and conductivity of the halogens is shown to be due to the stabilisation of one of the resonating forms by solvents. As mentioned earlier the same theory can explain the anomalous value of γ for coloured diatomic molecules.

36. A Possible Explanation of Joshi Effect.

SAIYID SHAMIM-AHMAD, Aligarh.

An explanation of Joshi Effect is put forward on the basis of the theory of the resonating semipolar single bond developed earlier to explain the anomalous colour, (molecular) reactivity, dipole moment in solution, ratio of specific heats for halogens etc. The theory postulates: I. Formation of a polarised wall complex which under the applied field can ionise at a lower voltage than the molecules in the bulk.

II. Under the influence of light this complex dissociates into neutral particles and possibly also into negative ions.

Ageing, influence of the nature of the gas, nature of surfaces, temperature, pressure are explained as influencing the formation of the polarised complex. Threshold potential is the ionising potential of the boundary complex. Fall in conductivity, influence of intensity and frequency of light non-dependence on selective absorption, suppression of high frequencies and positive Joshi Effect are explained as due to the break up of the boundary complex.

37. Solvent and Chain Transfer.

SADHAN BASU, JYOTIRINDRA NATH SEN *and* SANTI R. PALIT, Calcutta.

It has long been known that certain solvents reduce the molecular weight of the polymers formed in solution. Flory has assumed that this is due to the fact that the solvent molecules can transfer an atom or a group of atoms to the growing polymer radical. The reactivity of the polymer is thus transferred to the solvent residue which may in its turn propagate a new chain. Working on this assumption Mayo has deduced a relation for the polymerization of a monomer in solution.

$$\frac{1}{P} = C\left(\frac{[S]}{[M]}\right) + \frac{1}{P_0}$$

where P is the number-average degree of polymerization in solution, P_0 that in the bulk, [S]/[M] is the mole ratio of solvent to monomer and C is a constant, called the chain transfer constant. Mayo has calculated the value of C for the polymerization of styrene in various solvents.

We have tested the equation for the polymerization of methyl methacrylate in various solvents, and the calculated values of C for those cases are given in the following table.

Solvent	Chain Transfer coefficient x 10^5
Benzene	0.72
Cyclohexane	0.80
Toluene	2.75
Ethyl benzene	17.00
Chlorobenzene	2.00
Chloroform	14.00
Propylene chloride	10.00
Carbontetrachloride	23.93
Dioxane	2.22
Methyl ethyl ketone	7.00
n-Butyl alcohol	3.33

With the hydrocarbons benzene and cyclohexane, the transfer constant is very small; the value increases from toluene to ethyl benzene. Chloro-benzene has got transfer constant, but in aliphatic chloro-compounds the transfer constants are extremely high, the activity increasing with increase in chlorine content. Ether (dioxane), Ketone (methyl ethyl Ketone) and alcohol (n-butyl alcohol) have got transfer constants higher than those of hydrocarbons, the ketonic compound being the most effective.

38. Solubilization of Water in Organic Solvents by Dodecylammonium Salts.

VEDANTAM VENKATESWARLU AND SANTI R. PALIT, Calcutta.

Cationic detergents of the type of dodecylamine salts are well known surface active agents and they are expected to be powerful solubilizers. A systematic study of the phenomenon of solubilization has been undertaken employing the dodecylamine salts of the fatty acid series as detergents. The solubilization studied is not of the usual type using water as the solvent but is of the reverse type, i.e., water-in-nonaqueous solvents. Preliminary experiments with dodecylamine oleate in a number of nonpolar solvents showed that the maximum amount of water is solubilized when xylene is used as the medium, and hence all subsequent experiments were done in xylene.

The usual procedure was to take 1 gm. of the solubilizer in 5 cc. of xylene and to measure the volume of water which goes in without producing any turbidity or emulsification. Using the series of fatty acids it was observed that the maximum amount of water is solubilized with dodecylamine -n-butyrate and isobutyrate and the value decreases appreciably with higher or lower homologues. The data are given in the following table :

TABLE

Solubilizer		gm. of water solubilized per gm. of detergent at 31°C.
Dodecylamine	Formate	0.07
,,	Acetate	0.15
,,	Propionate	0.57
,,	n-Butyrate	1.84
,,	iso-Butyrate	1.94
,,	Valerate	0.62
,,	Caproate	0.25
,,	Laurate	0.18 (at 50°-60°C)
,,	Palmitate	0.25 (at 50°-60°C)
	Oleate	0.08

It was also found that the presence of either an excess of the amine or of butyric acid increases the maximum volume of water solubilized. For example, with 80 per cent excess of amine the volume of water dissolved is doubled while 20% excess butyric acid increases the volume by about 50%.

39. Limits of Supersaturation in Solutions of Solid Non-Electrolytes.

A. C. CHATTERJEE, RAM GOPAL, A. N. BOSE *and* R. P. RASTOGI, Lucknow.

Supersaturation of non-electrolytes in non-aqueous solvents has been stuided and it is shown that practical and theoretical limits are very much similar provided the internal pressure of the solvent and the solute is taken into consideration. It is pointed out that the limits of supersaturation cannot be predicated very accurately due to uncertainty in fixing up the exact values for 'r' and 'σ'.

40. Entropy of Solution, Free Energy Barrier of Nucleus Formation and the Limits of Supersaturation.

RAM GOPAL *and* R. P. RASTOGI, Lucknow.

An attempt has been made to find out whether any relationship exists between the maximum free energy barrier $F_{max.}$ $\left\{ = \frac{32\sigma^3}{H^2}\left(\frac{T_s}{T_s - T}\right)^2 \right\}$ of nucleus formation and the limits of supersaturation in a number aqueous and non-aqueous solutions. Due to the fact that the expresiion for $F_{max.}$ involves factors which are either completely unknown or known only very roughly, it is not possible to draw any definite conclusion. But some results and hypothetical intuition is definitely indicative that the F_{max}. barrier can be easily surmounted at the various limits of supersaturation in different cases. Further light on the problen is expected from a study of simpler systems like melts whose supercooling is being investigated in this laboratory.

It also appears that entropy of solutions is roughly inversly proportional to the limits of supersaturation.

41. Supersaturation Limits of Solutions in Presence of Foreign Substances Part I.

A. C. CHATTERJEE *and* R. P. RASTOGI, Lucknow.

The effect of various substances on the limits of supersaturation of aqueous solution of KCl has been studied. It is found that the limit is decreased in presence of alcohol, acetone etc. It has been pointed out that the decrease in inter-facial tension is responsible for this behaviour. In the case of dyes, marked heating effect is observed. An explanation of this action has also been offered.

42. Supersaturation Limits in Non-Aqueous Solutions. Part II.

A. C. CHATTERJEE, A. N. BOSE *and* R. P. RASTOGI, Lucknow.

It has been observed that for the solutions of the same solute in different solvents, the effect of heating is different. It is suggested that solution contains particles which act as adsorbents and adsorb solute. During the process of heating these solute particles go into the solution and hence heating effect is observed. Further, for the solutions of the same solute in different solvents amount of solute adsorbed is different and hence heating effect is different. In solutions where no solute is adsorbed by the adsorbate, heating effect is not observed. A detailed paper with experimental results supporting the above view will be published elsewhere.

43. Syneresis of Sodium Oleate Gels in Mixtures of Pinene and Xylene.

MATA PRASAD *and* V. SUNDARAM, Bombay.

Sodium oleate gels were prepared in mixtures of pinene and xylene containing varying amounts of the two solvents, and the amounts of syneresis of these gels have been measured after the same time interval. The syneresis is least in pure pinene and increases to a maximum value in pure xylene. The graphs of syneresis against the composition of the mixture are S-shaped which shows that the syneresis of these gels does not obey the additivity law.

44. Effect of Area of Gel Surface Exposed on the Syneresis of Sodium Oleate Gels in Pinene.

MATA PRASAD *and* V. SUNDARAM, Bombay.

The effect of area of gel surface exposed on the syneresis of sodium oleate gels in pinene has been determined. It is observed that syneresis is directly proportional to the specific surface per unit volume of the gel provided the thickness of the gel is small. When greater thicknesses of the gel are considered, syneresis is not directly proportional to the specific surface but is slighlty higher than the value calculated on the basis of the specific surface. This difference has been attributed to the hydrostatic preassure exerted by the column of the gel.

45. Effect of Temperature on the Syneresis of Sodium Oleate Gels in Pinene

MATA PRASAD *and* V. SUNDARAM, Bombay.

The effect of temperature on the syneresis of sodium oleate gels in pinene has been studied. Increase of temperature decreases the syneresis. The relation $Y^n = Kt$ where Y is the amount of syneresis in time t and n, K are constants, holds good for temperatures above 25°C and the value of n decreases with an increases in temperature. Below 25°C, the relation does not hold. There does not seem to be any direct relationship between syneresis and temperature. But, when the graphs of syneresis against temperature for each interval of time are extrapolated, all the graphs meet the temperature axis at a single point which closely agree with the gelation temperature ; this gives the inference that at the gelation temperature no syneresis takes place.

46. Gelation of Sodium Oleate and Sodium Stearate in Nujol.

MATA PRASAD, K. B. DESHPANDE *and* K. P. BUCH, Bombay.

Gels were prepared by dissolving different amounts of sodium olelate and sodium stearate in a definite volume of Nujol by heating to 200°C. The time of setting was determined for each gel at different rates of cooling. The results show that the time increases with slower rate of cooling for any given concentration and decreases with an increase in concentration. for the same rate of cooling. It was further noted that in all cases the temperature at the time of set (i.e. the temperature of set) for any given concentration is the same irrespective of the rate of cooling, unless the cooling is too rapid or too slow.

The cooling curves of these systems during setting show breaks which extend over a range around the temperature of setting. Calculation of the heat evolved during setting shows a fair constancy of the molar heat of gelation.

47. A Study on the Supercooling of Melts of Organic Substances.

RAM GOPAL *and* A. N. BOSE, Lucknow.

A study of the supercooling in organic melts reveals that the difference between the melting point T_m and T, the temperature of the first spontaneous crystallisation, is almost a constant in most of the cases. In many cases *e.g.* benezophenone and 1—chloro —2:4-dinitrobenzene, melts do not crystallise at all unless inocculated.

Calculations of F_{max}, the maximum free energy barrier for the nucleus formation, reveal that it falls into two categories, although at persent no definite conclusion can be drawn.

48. Polymerization in the Solubilized State.

RANAJIT SENGUPTA *and* SANTI R. PALIT, Calcutta.

Styrene has only limited solubility in propylene glycol near room temperature but they are completely miscible with additiion of enough soap, *e.g.*, sodium oleate. We have studied the polymerization of styrene thus solubilized in propylene glycol using ammonium persulphate as catalyst. This study is of evident interest in connection with the mechanism of emulsion polymerization.

We have found that the system has a high oxygen sensitivity, the reaction being inhibited by traces of oxygen. Speed of the polymerization process is fairly high (about 2.6% per hour with 0.1 mol per cent of the catalyst at 40°C.). Further a small variation in the soap concentration does not change the speed to a marked degree.

The results indicate that there is no essential difference between the catalysed polymerization in homogeneous solution, the polymerization in solublized state and the emulsion polymerization.

49. Ferric Oleate as Catalyst in Vinyl Polymerization.

JYOTIRINDRA NATH SEN *and* SANTI R. PALIT, Calcutta.

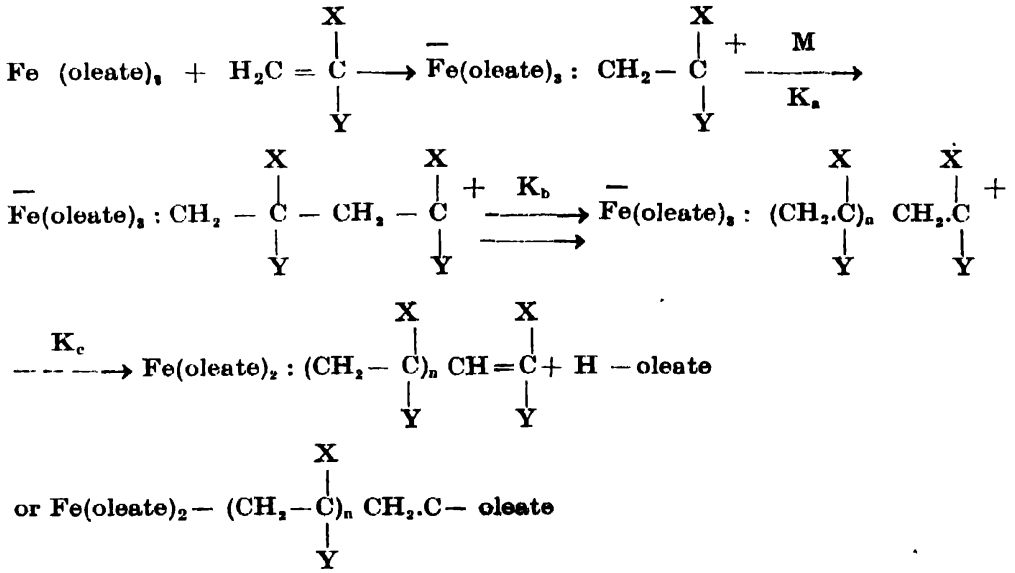
It was observed in an earlier work from this laboratory that the presence of ferric oleate tends to increase the speed of peroxide-catalysed polymerization of styrene in solution. It occurred to us that the above conditions are very unfavourable for studying the effect of ferric oleate itself, as the high catalyst concentration and low concentration of the monomer might mask the effect. Hence, the effect of ferric oleate on the uncatalysed polymerization in bulk as also in stronger solution has been studied and the work has been extended to methyl methacrylate. Our expectation was confirmed and it was found that ferric oleate is a fairly strong catalyst for the above polymerizations, the catalytic power being enough to produce pereeptible polymerization of styrene or methyl methacrylate in bulk even at room temperature in less than a day.

Experiments were conducted with 0.2 weight per cent ferric oleate (approximately, 1 mol. ferric oleate per 4,500 mol monomer) for bulk polymerization in vacuum of styrene and methyl methacrylate at 35°C and 80°C. Reckoning from the initial slope of the yield curve, the catalytic effect is found to increase the speed for styrene polymerization from an yield of 0.6 to 1.63 per cent per hour at 80°, and from 0.2 to 5.75 per cent per day at 35°C ; for methyl methacrylate the uncatalysed yield of polymer is 1.08 per cent per hour at 80° whereas the presence of ferric oleate produces 2.34 per cent per hour at the same temperture. The intrinsic viscosity of the catalysed and the uncatalysed polymers was determined. Some illustrative data are as follows :

TABLE

Polymethyl methacrylate (80°C).	[η] Benzene	Molecular weight.
Uncatalysed	4.05	17.8×10^5
Catalysed	2.2	7.96×10^5
Polystyrene (80°C).		
Uncatalysed	2.35	9.74×10^5
Catalysed	1.90	5.81×10^5

It is further observed that the polymer contains iron, and the amount of iron is higher if prepared at a lower temperature. This iron is difficult to remove by the usual method or even by treatment with acid. Hence it is concluded that this iron is bound with the polymer molecule which leads us to believe that this is a case of polar polymerization probably by the followig mechanism :



$$\mathrm{Fe\ (oleate)_3} + \mathrm{H_2C} = \overset{\mathrm{X}}{\underset{\mathrm{Y}}{\mathrm{C}}} \longrightarrow \overset{-}{\mathrm{Fe(oleate)_3}} : \mathrm{CH_2} - \overset{\mathrm{X}}{\underset{\mathrm{Y}}{\mathrm{C}}}{}^{+} \xrightarrow[\mathrm{K_a}]{\mathrm{M}}$$

$$\overset{-}{\mathrm{Fe(oleate)_3}} : \mathrm{CH_2} - \overset{\mathrm{X}}{\underset{\mathrm{Y}}{\mathrm{C}}} - \mathrm{CH_2} - \overset{\mathrm{X}}{\underset{\mathrm{Y}}{\mathrm{C}}}{}^{+} \underset{\longrightarrow}{\xrightarrow{\mathrm{K_b}}} \overset{-}{\mathrm{Fe(oleate)_3}} : (\mathrm{CH_2}.\overset{\mathrm{X}}{\underset{\mathrm{Y}}{\mathrm{C}}})_n\ \mathrm{CH_2}.\overset{\dot{\mathrm{X}}}{\underset{\mathrm{Y}}{\mathrm{C}}}{}^{+}$$

$$\xrightarrow{\mathrm{K_c}} \mathrm{Fe(oleate)_2} : (\mathrm{CH_2} - \overset{\mathrm{X}}{\underset{\mathrm{Y}}{\mathrm{C}}})_n\ \mathrm{CH} = \overset{\mathrm{X}}{\underset{\mathrm{Y}}{\mathrm{C}}} + \mathrm{H - oleate}$$

$$\text{or } \mathrm{Fe(oleate)_2} - (\mathrm{CH_2} - \overset{\mathrm{X}}{\underset{\mathrm{Y}}{\mathrm{C}}})_n\ \mathrm{CH_2.C} - \mathrm{oleate}$$

Unlike usual type of polar polymerization as brought about by BF_3, $SnCl_4$, $TiCl_4$ etc., Ferric oleate initiates the polymerization at room temperature at a convenient rate and produces a polymer of fairly high molecuar weight and so this system is more easily studied and promises to enrich our knowledge about this type of polymerization.

Further experiments are in progress to know more details of the process and test the above hypothesis.

50. Retardation of Polymerization of Styrene and Methyl Methacrylate by Metallic Soaps.

JYOTIRINDRA NATH SEN *and* SANTI R. PALIT, Calcutta.

We have observed in a previous paper (communicated for publication to Indian Chemical Society) that some metallic soaps retard polymerization. We have continued the work with the oleates of various metals, viz., chromium, silver, cadmium, lead, copper and also a few surface active agents scuch as glycerol monostearate, triton N-100, aerosol OS and cetavlon. We have observed that all these substances retard polymerization whether the polymerization is thermal or peroxide catalysed, the monomer being either in bulk or in solution. The catalysed polymerization is found to be less retarded than the uncatalysed.

The retardation in the case of almost all the above compounds is small except in the cases of copper oleate and cetavlon where a strong retardation and sometimes complete inhibition takes place, We have carefully studied the inhibitory effect of copper oleate, all polymerization experiments being run in vacuo. The strong inhibition can be judged from the following typical example : 12 per cent solution of styrene in benzene at 80°C is polymerized to the extent of 9.5 per cent in 120 hours, but the presence of copper oleate to the extent of 0.01 per pent (one mol copper oleate per 7,000 mols styrene) inhibits the polymerization completely upto the same period under identical conditions. In the case of methylmethacrylate in bulk, at 80°, polymerization after a period of 22 hours was 33.6 per cent for the unretarded reaction and only 2.7 percent with 0.2 per cent added copper oleate.

In polymerization of styrene in benzene solution there is an apporoximate proportionality between the inhibition period and the concentration of copper oleate. This agrees with the previlousy observed behaviour of most inhibitors in bulk or in solution. However, this proportionality breaks down at lower concentration of copper oleate. In fact on closer study it is found out that as we go on decreasing the concentration of copper oleate the retardation slowly disappears and in sufficiently dilute solution acceleration is observed. For example, it is found that even 1.5 moles of copper oleate per one million moles of styrene perceptibly acclerate the polymerization of styrene in solution (1.15 molar). These experiments have been repeated and the results confirmed.

It is suggested that the cupric oleate is reduced to cuprous oleate as it exercises its inhibitory activity just as quinone is reduced to hydroquinone, and the cuprous oleate porduced by the reduction acts as the accelerator, probably by polar mechanism. Fnrther work is in progress to test this mechanism.

51. Physico-Chemical Properties of Carboxyethyl Cellulose.

PARES CHANDRA DAS GUPTA *and* SADHAN BASU, Calcutta.

An investigation of the properties of carboxy-ethyl cellulose and its sodium salt has been undertaken with a view to finding out its industrial uses like carboxy methyl cellulose. Preparation of the compound is much easier and the yield is also considerably higher than carboxy methyl cellulose. The preparation has been done from various cellulose, viz., filter-paper, adsorbent cotton (B.C.P.W.) and Doria cotton from Bombay by treating the sodio cellulose with equimolecular proportion of acrylo-nitrile in benzene and then hydrolysing the cyano compound with concentrated NaOH. The acid was isolated from the sodio salt by treating it with concentracted mineral acid. The extent of substitution was determined by electrometrically titrating the free acid with alkali using a glass electrode and a Beckman pH meter. The extent of substitution was in all cases about 0.28. The dissociation constant of the free acid was about 2.24×10^{-6} calculated from the pH at half-neutralisation point, much less than that of carboxy methyl cellulose. ($K_a = 5.1 \times 10^{-5}$)

The sodium salt of the acid was soluble in water, more so in a solution of sodium hydroxide but is precipitated from water with alcohol. On increasing the pH of the solution the viscosity of the aqueous solution of sodium salt falls rapidly at higher pH, but does not increase again on diminishing the pH. This is due to better dispersion of sodio-salt in alkali whereby free OH groups become highly solvated and thus do not agglomerate on neutralising the NaOH with acid.

Similarly on heating the solution of sodio-salt the viscosity falls which does not revert back to original value on cooling, the cause of which may be sought for in the same phenomenon, viz., better dispersion of the salt in water at higher temperature.

52. A New Method of Measuring Permeabilities of Oilsands.

N. C. SEN GUPTA, Digboi.

In the usual method of measuring permeabilities e.g. of oilsands, air at a constant pressure is passed through the specimen of known dimensions and the volume rate of flow is noted. Knowing the inlet and outlet pressures of air and its viscosity the permeability is calculated from Darcy's law. This method requires a steady supply of air at constant pressure and an accurate gas-meter. These may not be always available. In the method developed by the author air is pumped with an ordianry hand-pump into a glass bottle fitted with a manometer until a pressure some what above 0.5 atmosphere is obtained. The air is then allowed to flow through the specimen and the time required for the pressure to fall from e.g. 0.5 to 0.25 atmosphere is noted. The mean pressure can be obtained graphically to calculated the constant of the equation K = Const./*t*. An equation connecting permeability (K) with the initial and final pressures has also been derived :

$$K = \frac{\eta \ L \ V \ln \left(\frac{\Delta p_0}{\Delta p_t} \cdot \frac{2 \times \Delta p_t}{2 \times \Delta p_0} \right)}{t. \ A}$$

where η is the viscosity of air ; L, length of the cylindrical sample cf cross-section A ; V, volume of the bottle ; $\Delta \ p_0$, initial and $\Delta \ p_t$, final pressure of air in the bottle.

Results obtained by the new method agree closely with those obtained by the usual method.

53. Studies in Glass Systems—Refractometric Measurements of the System-Platinum-Lindemann Glass.

SUBODH KUMAR MAJUMDAR, Darjeeling.

The present work is an extension of the various papers published by the author on different glass systems, containing various polar crystals and noble metals. The present paper records the results obtained with the system Platinum dispersed in Lindemann glass.

Different samples of the glass were prepared by heating Lindemann glass and finely divided platinum obtained by first evaporating an aqueous solution of platinic chloride and then by strongly heating it in a platinum crucible. The platinum-contents of the samples were determined by reducing the platinum in solution by stannous chloride and matching with a standard solution in a Colorimeter.

The refractive index was determined by Becke method backed by a Pulfrich Refractometer. The densities were determined by a modified Floatation method (Majumdar and Sarma, J. Indian Chem. Soc., 1942, *19*, 241).

The results show a very interesting deviation from the other cases studied by the author. While in every other case, the specific refraction of the dispersed phase has been found to be smaller than the corresponding value in the pure state, in the present case, the reverse phenomenon has been noticed. The specific refraction of the platinum dispersed in Lindemann glass is found to be actually higher than that of the pure metal.

The magnetic susceptibility measurements of similar systems also reveal increased values of diamagnetic susceptibility of the dispersed phase. The magnetic and refractometric results are discussed. Magnetic measurements indicate an enlargement of the lattice i.e. increase of orbits of the loosely bound electrons in the metallic lattice., In the case of platinum only, refractometric measurements reveal higher values of mole refraction, supporting the magnetic data. In all other cases, studied so far, the magnetic and refractometric data run counter to each other. The subject has therefore great theoretical interest.

54. Colloid Chemistry of Metal Hydroxides. I. Alumina Gels.

B. P. GYANI, Patna.

Some indications of conditions have been found out under which a hard, transparent, and granular gel can be prepared. It is found that the ageing of the precipitated alumina at room temperature particularly in presence of large quantities of soluble salts leads to soft, chalky gels. Hard, fairly transparent gels may be prepared by precipitation from boiling solutions and immediate washing. The deterioration of the hydroxide may be prevented by the addition of small quantities of acetic acid.

55. Effect of Non-Electrolytes on the Antagonism of Ions in Coagulation of Sols.

L. POCHHALI *and* S. N. MUKHERJEE, Jadavpur.

Antagonism between different monovalent and divalent and monovalent and trivalent ions was studied with reference to the coagulation of Arsenious sulphide sol both in presence and absence of non-electrolytes. While no antagonism was observed between ions of same valency, that between monovalent and divalent ions was the most prominent. The most significant antagonism was observed in the KCl-$BaCl_2$ pair.

Of the effect of non-electrolytes on ionic antagonism area presents no appreciable difference from that of water, so far as KCl-$BaCl_2$ pair is concerned. The antagonism is very prominent in ethyl alcohol and runs in the order ethyl alcohol $>$ methyl alcohol $>$ cane sugar $>$ urea, water. In general the antagonism is maximum when the concentration of KCl is near about 50% of its own coagulating concentration.

56. Optical Properties of Zirconium Hydroxide Gels.

MATA PRASAD *and* K. E. S. MANI, Bombay.

Changes in the opacity and the depolarisation factors ($\int u$, $\int v$ and $\int h$) of light scattered transversely by zirconium hydroxide gels were measured at suitable intervals during gelation. The results indicate that the initial slight anisotropy of the particles decreases at the early stage of gelation but later on increases continuously throughout the course of gelation. There is also a gradual increase in the size of the particles during gelation, the ultimate size being smaller than the wave-length of light. These observations indicate that the process of gelation of zirconium hydroxide is similar to that of coagulation.

The addition of small quantities of HCl, HNO_3 or H_2SO_4 does not modify the course of gelation, but HCI and HNO_3 inhibit the agglomeration of the collcidal particles ; increasing concentration of the acids further retards agglomeration. The size, anisotropy and the number of gelling particles appear to be smaller in the presence of these acids. The addition of small quantity of sulphuric acid inhibits agglomeration, but larger amount increases it.

57. Optical Properties of Thorium Molybdate Gels.

MATA PRASAD *and* K. E. S. MANI, Bombay.

The changes in opacity and the depolarisation factors ($\int u$, $\int v$ and $\int h$) of the light scattered transversely by thorium molybdate gels during gelation were determined at suitable intervals. The results indicate that the colloidal solution of thorium molybdate consists of small fairly anisotropic particles at the initial stage. During gelation, the particles continuously increase in size but decrease in anisotropy until they attain a constant size (smaller than the wave-length of light) and become nearly isotropic in structure. The opacity of the gels decreases continuously during gelation and the process of gelation is similar to that of coagulation.

The addition of small quantities of the acids to these gels does not modify the course of gelation. The acids peptise the colloidal aggregates of thorium molybdate, and hence the initial and the final sizes and the anisotropy of the particles in gels containing acids are smaller than those of particles in gels prepared without the addition of acids. The peptising effect becomes greater, the larger the quantity of the acid added. The final values of opacity for gels containing acids indicate the possibility of acids dissolving some of the colloidal matter. Further, the solvent action of the acids in such gels becomes more pronounced with larger amount of the acid.

58. Effect of Irradiation on the Absorption of Anthracene Solution in Benzene.

(MISS) K. K. ROHATGI *and* S. N. MUKHERJEE, Jadavpur.

In continuation of the work reported last year on the effect of irradiation on a solution of anthracene in benzene containing varying quantities of CCl_4, spectrophotometric study of such irradiated solutions was persued. Absorptions of the solutions irradiated at 3650 A° for varying durations were studied, in the range of 2200 A° – 5000 A° against non-irradiated solutions of the corresponding concentrations.

From the nature of the absorption curves, it appears that the absorption of anthracene is considerably changed by these irradiations. On keeping these irradiated solutions in the dark, although absorption increases but the curve does not exactly simulate that of anthracene.

59. Dipole Moments of Metallic Soaps.

BIRENDRA CHANDRA BANERJEE *and* SANTI R. PALIT, Calcutta

The dipole moments of seven metallic soaps, viz,. the oleates of Mg, Ca, Zn, Cd, Pb, Cu and Ni, have been determined by a heterodyne beat method. The values are 4.97 D, 5.01 D, 0.82 D, 3.2 D, 3.2 D, 1.68 D and 4.10 D respectively.

Though the metallic soaps are generally regarded as nonpolar from their physicochemical, particularly, solubility behaviour, being completely soluble in organic solvents, these data show them to be fairly highly polar. It is suggested that this high polarity is caused not by high charge but by a comparatively large separation between the charges owing to the centre of negative charge residing well within the hydrocarbon radical of the oleates. This shifting of the centre of negative charge from the — COO^- end to the adjacent hydrocarbon radical is supposed to be caused by an inductive effect due to the repulsion experienced by the bonding electron pair of the $\overrightarrow{C:H}$ bond from the negative charge which causes all C-H bonds to the polarised, the nearer C-H bonds being polarised more than the distant bonds.

It is further observed from an examination of the μ-values of the group II elements, Mg, Ca, Zn, and Cd oleates that the order of their dipole moments is opposite to the order of their ionisation potentials.

Calculation of μ-values has also been made according to a new equation developed by Jatkar, Sathe and Iyengar based on Debye's method of treatment with a few quantum restrictions as to the orientation of the dipoles in the electric field. It is found that μ-(Jatkar et al.) is always lower than μ(Debye). It is further observed that P_2 (total polarization) is strongly dependent on concentration both in the new and in the classical Debye equation and so the new equation does not offer any advantage over the Debye equation in these cases.

60. Bromination of Sodium Acetate in Glacial Acetic Acid Medium.

MIHIR NATH DAS *and* SANTI R. PALIT, Calcutta.

It was reported earlier (Das, Science & Culture, *14*, 165, 1948; Das and Palit, J.I.C.S., July 1949) that bromine readily reacts with sodium acetate dissolved in glacial acetic acid. From a kinetic study it has been found that the reaction is a bimolecular one and can be represented as follows:

$$CH_3\ CO.O + Br_2 = CH_2Br.\ CO.O + H^+ + Br \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

$$CH_3\ CO.O + H^+ = CH_3\ CO.OH$$

The second step of the reaction is obviously an instantaneous process, so that the first step is the rate determining factor. In order to minimise the complications involved due to tri-bromide formation, the reaction was carried out in presence of excess bromide, for it can be shown that under these conditions, free bromine at any stage of the reaction is a constant fraction of the total titratable bromine. If *a* and *b* denote the initial molar concentrations of bromine and acetate respectively, the kinetic equation can be represented by $\frac{dx}{dt} = k\,(b\text{-}2x)\,(a-x)\,\alpha$. where α is a constant for the particular bromide and bromine concentrations used. The experimental results were found to be in excellent agreement with this equation. The values αk_2 were obtained graphically, from which the bimolecular constant k_2 was calculated. Using various bromide concentrations ranging from 0.09 to 0.26 M, the values of k_2 were found to lie in the range 1.85—2.26 litre gm./mole min^{-1} at 35°C. The divergence in the values is possibly due to variable amounts of water likely to be associated with different samples of acetic acid used in different sets of experiments, for water strongly accelerates the reaction. Using a highly purified sample of acetic acid, the values of k_2 at several bromide concentrations from 0.109—0.168 M were found to lie in the range 1.85—1.94, the mean value being 1.90 litre gm./mole min^{-1} at 35°C. From the temperature coefficient of the reaction, the activation energy is found to be of the order of 15.6 K. cals/mole.

Water strongly accelerates the reaction. In aqueous acetic acid containing 20% water the reaction is still bimolecular the speed being several times higher than in glacial acetic acid medium. But with higher proportions of water, the bi-molecular nature of the reaction is no longer evident. It is very interesting to note that in pure water, i.e., water containing no acetic acid, practically no reaction occurs.

Using different alkali acetates, the speed of the reaction is found to lie in the order $K > Na > Li$.

As regards the mechanism of the reaction, it may be suggested that, bromine being an electrophilic reagent in substitution reactions, the bromination of the acetate ion occurs due to an increased electron density at the α-carbon atom, resulting from an operation of the $+I$ effect of the negatively charged oxygen at the carboxylate end.

61. Catalytic Decomposition of Potassium Chlorate in the Pressence of of Molybdic Acid, Chloroauric Acid and Chloro-Platinic Acid.

G. B. KOLHATKAR *and* L. M. APTE, Sangli.

The mixtures of Molybdic acid, Chloroauric acid and Chloroplatinic acid and of Potassium Chlorate, in the proportion of 1 to 10 are heated at suitable temperatures and the decomposition of Potassium Chlorate is studied as a time reaction by measuring the Oxygen evolved at definite intervals of time. With Molybdic acid and Chloroauric acid, the temperature required to start the decomposition is in the neighbourhood of 275°, while with Chloroplatinic acid it is much higher.

62. Variation of Relative Viscosity with Temperature (Non-Aqueous Solutions of Electrolytes and Non-Electrolytes).

A. C. CHATTERJEE *and* A. N. BOSE, Lucknow.

The variation of relative viscosity with temperature has been studied. It has been observed that the value of $\frac{S}{\delta t}\left(\frac{\eta_s}{\eta_s}\right)$ is negative for all the solutions studied here.

63. Viscosity of Unimolecular Surface Films.

A. K. MUKHERJEE *and* S. N. MUKHERJEE, Jadavpur.

Boyd and Harkin's empirical equation relating surface viscosity of unimolecular films and the surface pressure has been deduced theoretically by a thermodynamic treatment from the fluidity equation as deduced above.

64. Relation Between Viscosity of Liquids and Temperature.

A. K. MUKHERJEE *and* S. N. MUKHERJEE, Jadavpur.

A new relation between viscosity of liquids with temperature has been deduced theoretically through the partition function of a molecule in the liquid state. The equation has been tested for a large number of normal liquids and has been found to be in better agreement with facts than the long established equation :

$$\log \eta = A + \frac{B}{T}$$

No mechanism of viscous flow has been assumed in the theoretical treatment.

65. Kelly Tube for Sedimentation Analysis.

V. V. DESHPANDE *and* M. S. TELANG, Nagpur.

Some authors have given an elaborate calculation of the correction factor to be included in the original Kelly equation (Ind. Eng. Chem., *16*, 928, 1924) to account for the progressive increase in the liquid level in the settling tube due to the recession of the liquid from the capillary side-arm. The present paper describes a practical device for maintaining the liquid level in the settling tube constant so as to retain the validity of the original Kelly equation. Furthermore, ordinary methods of measuring the angle of inclination of the capillary side-arm of Kelly tube in the working position of the apparatus after placing it in a thermostatic bath may lead to considerable and uncertain errors. This fact has been one of the major drawbacks of Kelly's apparatus. The constant-level device is further useful in the precision determination of the angle of inclination of the capillary side-arm.

66. Adsorption of Neutral Red on Metal Surfaces.

K. K. DOLE *and* B. W. KELKAR, Poona.

Neutral red is adsorbed in multilayers on pure copper plates, copper plates thickly coated with mercury, and iron plates deposited with copper. During the adsorption of neutral red some needle like substance is separated, which is insoluble in water but soluble in benezene to a yellow coloured solution. This indicates orientation of molecules during the course of adsorption. Addition of acetic acid to the dye solution slightly increases the adsorbtion coefficient while addition of small amounts of sodium hydroxide increases the coefficient to a great extent. It indicates that there is a pH which will give maximum adsorption. The adsorption on copper is twice that on the mercury plates. Further work on the relation of pH to adsorption is in progress.

67. Adsorption of Methyl Orange on Metal Surfaces.

K. K. DOLE *and* B. W. KELKAR, Poona.

Pure copper plates, iron plates with an uniform deposited layer of copper and thickly mercury-coated copper plates have been used for the studies of adsorption of dyes on metallic surfaces. Deposited copper adsorbs dyes very strongly, perhaps the specific surface available for adsorption is larger than in the case of copper plates. Multilayer adsorption is observed in both pure copper plates and the mercury coated copper plates. Addition of small quantities of acids and alkalis has a great influence on the adsorption, thus sodium hydroxide, acetic acid and sodium chloride inhibit the process of adsorption, while sodium acetate and sodium bicarbonate are seen to increase the adsorption. However, sodium carbonate suppresses the adsorption indicating that there is a definite range of pH for maximum adsorption. Coefficient of adsorption of copper plates is about 2.5 times greater than the mercury coated plates.

68. Adsorption of Dyes on Mercury Surfaces.

K. K. DOLE *and* B. W. KELKAR, Poona.

Adsorption of several dyes on copper plates thickly mercury coated is studied in the present investigation. Several interesting features have been observed, the most important being the multilayer adsorption of dyes. The adsorption coefficient of dyes depends upon the constitution of the dyes and orientation of the dye molecules on the mercury surface. The adsorption coefficient increases in the following order: sodium indigo sulphonate, methyl violet, crystal violet, Bismark brown, methyl green, methylene blue, methyl orange. In addition to oriented adsorption , selective adsorption seems to take place. Change of colour of the dye also takes place in many dyes and this has been attributed to oriented adsorption. But in the cases of aniline blue, neutral red and congo red colour change varies according to the extent of adsorption. The cause of this latter change is yet to be elucidated and further work in this direction is in progress. Influence of change of pH on the adsorption of dyes has also been studied and is found to be dependent on the nature of the dye. Adsorption of methyl orange is completly supressed in alcoholic solution, while that of neutral red is increased. Similarly, congo red is not adsorbed in alcholic solution. Further work about the influence of addition of foreign substances is in progress.

Organic Chemistry

69. Chemical Investigation of Indigenous Medicinal Plants.—Part I. Aohyranthes Aspera.

V. J. Dalvi *and* R. C. Shah, Bombay.

Achyranthes aspera (N.O. *Amarantaceæ*) possesses valuable medicinal properties as a pungent laxative and is considered useful in dropsy, piles, boils, eruptions of the skin etc. Dymock, Warden and Hooper (Pharmacographia Indica, Vol. III, p. 135) have carried out the ash determination of the leaves, stems and roots and examined the ash contents, but they have not been able to isolate any definite constituent from the plant material.

In the present investigation the stems dried at 100°C gave 8.578% ash. A qualitative analysis of the ash inicated the presence of Fe'', Al'', Ca'', K', Na' and SO_4'', CO_3'' Cl', PO_4'''.

The air dried stems of the plant on extraction with pertroleum ether yielded a colourless crystalline compound giving colour reactions for phytosterols. An examination of the hydrochloric acid extract indicates the presence of an alkaloid. Further investigation is in progress.

70. Chemical Examination of Enhydra fluctuans Lour.

R. N. Chakravarti *and* A. Dutta, Calcutta.

Enhydra fluctuans (N.O. Compositæ) is a marsh herb common in Bengal and Assam. Its leaves are slightly bitter and are used as a cure for inflammations, leucoderma, bronchitis, skin diseases, neuralgia ane other nervous diseases and in torpidity of liver.

Moisture content of the plant was found to be over 90%. Preliminary examination revealed the existence of a trace of an alkaloid. Systematic examination of the dry plant gave 0.021 per cent of an essential oil, 4.7 per cent of a non-volatile non-saponifiable matter and a minute quantity of a bitter substance soluble in hydroxylic solvents. The non- saponifiable fraction on crystallisation and chromatography gave 7.5 per cent of stigmasterol, m.p. 167°, which gave an acetate m.p. 144° and a benzoate m.p. 160°(mixed m.p. with authentic specimens compared). No other sterols could be isolated in a state of purity. The existence of stigmasterol as the chief constituent in the sterol fraction of this particular plant is noteworthy in view of the general belief that stigmasterol occurs in plants almost always associated with much larger quantities of α-, β-, γ-sitosterols and other phytosterols.

Quantitative determination of inorganic constituents of the plant was also carried out. Further work is in progress.

71. Chemical Investigation of Holbaelia Latifola: Isolation of a Glucoside.

D. Chakravarti *and* Asoka Kumar Mitra, Calcutta.

From the alcoholic extract of the stem of *Holbœlia Latifolia* (Nep.—Gophla) a glucoside m.p. 230°-235° (decomp) has been obtainted which is found to be haemolytic and poisonous to fishes. It has been hydrolysed and the sugar has been identified as galactose by the formation of the osazone. The aglucone (m.p. 295°-300°), decomp) is obtained as needles. (Found : C. 76.21%, H, 10.11%). It forms acetyl (m.p.163°-165°) and methoxyl (m.p. 223°-224°) derivatives.

72. On the Formation of 2 : 4-Bis-diazophenol.

D. P. Burma *and* B. Banerjee, Calcutta.

2,4 Bis-diazophenol is always formed in minute traces when p-hydroxyazobenzene is prepared by coupling of one molecule of diazonium chloride with one molecule of sodium phenolate. 2,4 Bis-diazophenol accompanies p-hydroxyazobenzene as a dark tarry product which separates out first from alcoholic solution. So far our knowledge goes, no where in the literature this has been previously mentioned.

73. Synthesis of Bridged-Ring System.

Nripendra Nath Chatterjee, Calcutta.

Ethyl Δ^1—tetrahydrobenzoate is condensed with ethyl sodiocyanacetate, and the resulting sodio-derivative is allowed to react with ethyl bromoacetate when ethyl l-carbethoxy cyclohexane-2-cyanosuccinate (b.p. 204°–206°/4 mm) is obtained. This on hydrolysis by means of sulphuric acid (20%) gives a very good yield of l-carboxycyclohexane-2-succinic acid. The gummy acid is esterified when a quantitative yield of the triester (b.p.177°-185°/7mm.) is obtained. The ester is cyclised with granulated sodium to yield ethyl (0:3:4-bi-cyclo)-nonan-2-one 3:4-dicarboxylate (b.p. 188°/8 mm.). It gives violet coloration in alcoholic solution with ferric chloride and when hydrolysed by means of sulphuric acid gives (0:3:4-bicyclo)-nonan-2-one-4-carboxylic acid (m.p. 136°C)which possesses all the properties of a keto-acid and on esterification furnishes the required keto-ester (143°-44°/8 mm.) in a quantitative yield. This keto ester is allowed to react with ethyl-bromo-acetate in presence of zinc wool when a product is obtained which seems to be a mixture of the unsaturated esters and diethyl (0:3:4-bicyclo)-nonan-2-hydroxy-2-acetate-4-carboxylate. This on dehydration and catalytic reduction gives ethyl (0:3:4-bicyclo)-nonan-2-acetate-4-carboxylate (b.p. 165°-70°/6) mm.),On hydrolysis by means of alcoholic potash the above ester gives (0:3:4-bicyclo)-nonan-4-carboxylic-2-acetic acid. This is treated with acetic anhydride and distilled in vacuum when 1:4-endomethylene decahydronaphthalene-2-one (b.p. 105°-10°/9 mm.) is obtained. 1:4-Endomethylene decahydronaphthalene (b.p.78°-80°/11 mm.) is obtained by Clemmensen reduction of the ketone.

74. Studies in the Diphenyl Series.

I. K. Kacker *and* S. H. Zaheer, Hyderabad-Dn.

During the course of study in the preparation of substituted phenanthrenes starting from 2- substituted diphenyls, 2-amino-3:5-dinitro-diphenyl, prepared by the method of Bradsher and Amore (J.A.C.S., 1944, *66*, 1283), was diazotised with nitrosyl-sulphuric acid in acetic acid and subsequently treated, in cold, with a solution of potassium nickelocyanide, with regular additions of sodium carbonate to keep the solution neutral. The 2-cyano-3:5- dinitro-diphenyl formed was isolated in the usual manner and crystallised from acetone-methyl alcohol giving a yellow crystalline substance melting at 244-45°. The nitrile, so obtained, on hydrolysis with 70% sulphuric acid at 140° for 4 hours and subsequent usual isolation treament did not give an acid (insoluble in Na_2CO_3) but the amide, crystallizing from methyl alcohol as a light yellow crystalline substance m.p. 214-15°C.

75. Studies in the Oxidation of Indigo for the Preparation of Isatin.

S. K. Saha, Calcutta.

Oxidation of Indigo, both synthetic and natural, by means of Sodium Dichromate and various acids and under varying conditions has been studied. Best yield of Isatin has been obtained by oxidising Indigo with dilute Sulphuric Acid and dichromate mixture at the optimum temperature of 45°C.

From the point of view of industry, it is advisable to prepare Isatin by oxidising synthetic Indigo or Indigo containing more than 90 per cent of Indigotin, which gives almost the theoretical yield of Isatin by the sulphuric acid method. Natural Indigo is uneconomic for the purpose.

76. On Certain Keto-Sulphones.

U. P. Basu *and* A. K Sen, Calcutta.

4-Amino-benzene-sulphinic acid is being condensed with alpha-beta unsaturated ketones obtained by reacting salicylaldehyde or cinnamic aldehyde with suitable ketones. The above acid also condenses with Coumarin derivatives to give rise to Sulpho-coumarin derivatives. Their characteristics are being studied for evaluating their efficacy against acid-fast organisms.

77. Schiff's Bases from Diamino Diphenyl Sulfone.

U. P. Basu *and* K. R. Chandran, Calcutta.

4:4′-Diamino diphenyl sulphone is known to have powerful antibacterial properties, but is somewhat toxic. Its several derivatives are now being advantageously used in the treatment of leprosy and even pulmonary tuberculosis. As the biological reaction of the drug is often believed to be due to the presence of one amino grouping (*cf.* Smith *et al*, Proc. Soc. Expt. Biol. Med., 1947, *64*, 261), Schiff's bases from 4:4 diamino diphenyl sulphone with unsymmetrical grouping are being considered to be of interest.

Accordingly, several 4:4′-derivatives such as salicylidene-cinnamylidene, benzylidene-cinnamylidene, disalicylidene, salicylidene-ethylidene, acetyl-cinnamylidene and acetyl-salicylidene—of diamino diphenyl sulphones have been prepared.

78. Certain Derivatives of 4-Amino Diphenyl Sulphones.

U. P. Basu *and* K. R. Chandran, Calcutta.

The sulfa drug action is being believed to be brought about by combination of the drug through its basic amino group with some enzyme systems of the organism (*cf.*, Klotz, *J. Amer. Chem. Soc.*, 1944, *66*, 459), and it is in this reaction that it displaces p-aminobenzoic acid from an active centre in an enzymic surface or compete with it for the formation of enzyme complex. As such it may be of interest to synthesise some mono-amino-diphenyl sulphone (*cf.* Bauer, *J. Amer. chem. Soc.*, 1948, *70*, 2254) derivatives in order to find a product that may easily form an enzyme-drug complex at the site of infection.

With this end in view derivatives of 2:5-dihydroxy-4-amino diphenyl sulphones and 2:4 dinitro-4-amino-diphenyl sulphones have been prepared from benzaldehyde and cinnamic aldehyde. The activity of these compounds are being studied.

79. A New Method for the Preparation of 4:4′-dinitro-diphenylsulphide and a Modification in the Process for the Reduction of 4:4′-dinitro-diphenyl Sulphone.

H. G. Biswas, Calcutta.

A new method for the preparation of 4:4'-dinitrodiphenyl-sulphide, which forms the starting material for the preparation of 4:4′-diaminodiphenyl sulphone, the mother substance of the well-known anti-leprosy drugs Diasone and Sulphetrone has been described. A modification in the process for the reduction of 4:4′-dinitrodiphenyl sulphone into 4:4′-diaminodiphenyl-sulphone has also been given

80. Chemotherapeutic Studies on Organo—Antimony Compounds.

S. J. Das Gupta, Calcutta.

Now-a-days sodium antimony gluconate in aqueous solution is much used in Kala-azar (leishmaniasis). This product has the following advantages over Urea-stibamine and other antimonials :—

(1) Its toxicity is much lower and reactions are fewer.

(2) It can be administered by any parenteral route.

(3) Its aqueous solution can be kept for a long period without any chemical or pharmacological change.

As the methods of preparation of the above antimony compound as found in literature are lacking in experimental details, a detailed as well as economic process for preparing this antimonial has been worked out and described in this paper. Pure antimony trioxide was oxidised with iodine to antimony pentoxide which was converted to antimonic acid and reacted with calcium gluconate. Calcium was removed by adding sulphuric acid and the resulting acid was neutralised with caustic soda when a solution of sodium antimony gluconate was obtained which was evaporated on steam bath for proper concentration. This solution has remained stable for over a year and found suitable for both intravenous and intramuscular injection.

81. Synthesis of Diamidines containing Arsenious Acid Group.

T. N. GHOSH, Calcutta.

In order to ascertain whether the presence of both arsenic and amidino groups in one molecule will stimulate, or suppress, trypanocidal activity, some diamidines containing arsenious acid group have now been synthesised for pharmacological examination. *p*-Cyanoacetanilide or *p*-Cyanobenzanilide has been condensed with *p*-arsanilic acid in presence of phosphorus oxychloride to yield N-alkylated amidines, containing arsenious acid as well as cyano groups. These compounds have readily furnished the arsenious acid derivatives containing an unsubstituted and a substituted amidino groups, *via* the corresponding imino-ether hydrochlorides obtained in excellent yields in presence of nitrobenzene. These diamidines readily respond to the specific colour reaction as discovered by Fuller (*Nature*, 1944, *154*, 773) for unsubstituted aromatic amidines.

82. On the Synthesis of Diamidines and Triamidines.

T. N. GHOSH, Calcutta.

In recent years some diamidines have been found to display high bacteriostatic activity against gram-positive and gram-negative bacteria and appear to be promising antibacterial agents suitable for use in surface infections (Thrower and Valentine, *Lancet*, 1943, 133 ; Wien *et al.*,*ibid.*, 1948, 771). In view of these interesting observations, it has been considered desirable to synthesis some diamidines and triamidines (each containing a substituted amidino group) and study their antibacterial properties.

Acetanilide has been condensed with *p*-cyanoaniline in presence of $POCl_3$ to yield (phenyl)-(*p*-cyanophenyl)-acetamidine (I). Similarly, di-(*p*-cyanophenyl)-acetamidine (II) has been obtained by condensing *p*-cyanoacetanilide with *p*-cyano-aniline. These compounds (I and II) are being converted into diamidine and triamidine derivatives respectively, *via* their corresponding imino ether hydrochlorides.

83. Synthesis of 3-Methyl-4″-Methyoxy-7′:8′-Furoflavone, by the Kostanecki and Feuerstein reaction, from 3-Methyl-4-Hydroxy-5-Acetyl-Coumarone.

S. D. LIMAYE *and* G. V. BHIDE, Poona.

3-Methyl-4-hydroxy-5-acetyl-coumarone, m.p. 70°, (Limaye and Nagarkar, *Rasayanam*, 1943, *1* 256), (I), gave on condensation with anisaldehyde a compound, m.p. 152°, $C_{19}H_{16}O_4$, giving colouration with ferric chloride and regenerating on hydrolysis the original ketone and aldehyde, and hence represented as (3′-methyl-4′-hydroxy-coumarone-5′) (4-methoxy-styryl) ketone (II). The acetate of (II), $C_{21}H_{18}O_5$, m.p. 108-109°, (III) gave by the action of bromine (one mol.) in acetic acid a monobromide, m.p. 170°, $C_{19}H_{15}O_4Br$, (IV), giving colouration with ferric chloride and forming an acetate, m.p. 135°, $C_{21}H_{17}O_5Br$. Since (IV) was also obtained from 2-bromo-3-methyl-4-hydroxy-5 acetyl-coumarone, m.p. 123°, $C_{11}H_9O_3$ Br, prepared from (I), by condensation with anisaldehyde, it could be represented as the 2′-bromo-derivative of (II). With two mols. of bromine (III) gave a compound, m.p. 152°, $C_{21}H_{17}O_5Br_2$, (V), which on treatment with hot alcoholic NaOH gave a compound, m.p. 240°, $C_{19}H_{13}O_4Br$, (VI), suffering on hydrolysis acid and ketone splitting yielding 2-bromo-homokaranjic acid, m.p. 226° (decomp) and (I). Hence (VI) could be represented as 2-bromo-3-methyl-4″-methoxy-7:8′-furoflavone, and (V) as (2′-bromo-3′ methyl -4′-acetoxy -coumarone-5′) (4-methoxy--styryl) ketone dibromide. However, when (III) was brominated in ether (3′-methyl-4′-acetoxy-coumarone-5′) (4-methoxystyryl) ketone dibromide, m.p. 145-46° (decomp.), $C_{21}H_{18}O_5Br_2$, was obtained, which on alkali treatment gave the bromine free 3-methyl-4″-methoxy-7′:8′-furoflavone, m.p. 223°, $C_{19}H_{14}O_4$, yielding on hydrolysis homokaranjic acid (Limaye and Limaye, *Rasayanam*, 1939, *1* 161). This procedure is utilised in similar syntheses which will be reported in due course.

84. Synthesis of (3-Methyl-6-Hydroxy-Coumarone-7)-Styryl Ketone and 3-Methyl-5′:6′-furo-Flavanone.

S. D. LIMAYE *and* K. G. MARATHE, Poona.

By the condensation of 3-methyl-6-hydroxy 7-acetyl-coumarone (Limaye and Sathe, *Rasayanam*, 1936, *1*, 48), with benzaldehyde in the presence of sodium hydroxide, two isomeric compounds have been obtained viz., (3-methyl-6-hydroxy-coumarone-7)

-styryl ketone, (I) m.p. 140°, $C_{18}H_{14}O_3$, giving colouration with ferric chloride, and 3-methyl-5′:6′-furo-flavanone, (II), m.p. 184°, giving no colouration with $FeCl_3$. (I) regenerates on hydrolysis the original ketone and aldehyde. Condensation products with other aldehydes are also in hand and will be reported separately.

85. Condensation of 2:4-Diacetyl-Phenol with Benzaldehyde.

S. D. Limaye *and* H. K. Pendse, Poona.

In all, four products have been isolated in the condensation of 2:4-diacetyl phenol and benzaldehyde viz. :—2-Hydroxy -5-acetyl- phenyl styryl ketone, m.p. 89°, $C_{17}H_{14}O_3$, giving colouration with ferric chloride (I) ; 6-acetyl-flavanone, m.p. 152°, $C_{17}H_{14}O_3$, (II) ; (2-hydroxy-phenylene-1:5)-bis-(styryl ketone) m.p. 155, $C_{24}H_{18}O_3$, giving colouration with ferric chloride, (III) ; and 6-cinnamoyl- flavanone, m.p. 170°, $C_{24}H_{18}O_3$, (IV). By the action of alcoholic hydrochloric acid (I) is converted into (II) ; and (III) into (IV). Caustic alkali converts (II) and (IV) into (I) and (III) respectively. Further, (II) gives under the action of sodium hydroxide (III) indicating the splitting off of benzaldehyde and its recondensation with the other acetyl group from (I) formed in the reaction.

The condensation products have been used for further syntheses which will be reported separately.

86. Thermal Rearrangement of the Para-Allyl Ether of Methyl β-Resorcylate.

S. D. Limaye *and* C. V. Kunte, Poona.

In contrast to the observation of Baker and Lothian (J.C.S., 1936, 274) in the case of the para allyal other of ethyl β-resorcylate, the para allyl ether of methyl β-resorcylate has yielded a Claisen transformation product, which on hydrolysis gives an acid, m.p. 140°, $C_{10}H_{10}O_4$, which may be represented as 3-allyl- β-resorcylic acid by analogy.

87. Action of Sodium Carbonate Solution on Coumarilic Acids.

S. D. Limaye *and* C. G. Joshi, Poona.

The following coumarilic acids suffer decarboxylation under the action of boiling sodium carbonate solution yielding the corresponding coumarones, which is in contrast to Pechmann and Hanke's observation in the case of 6-hydroxy-3-methyl-coumarilic acid (*Ber.*, 1901, *34* 354):—(i) 6-hydroxy-5-ethyl-3-methyl-coumarilic acid m.p. 222°, (Thakar, M.Sc. Thesis, Bom. Uni., 1946) ; (ii) 6-hydroxy--7acetyl-3-methyl-coumarilic acid, (Limaye and Sathe, *Rasayanam*, 1936, *1* 48) ; (iii) 6-hydroxy-7-benzoyl-3-methyl-coumarlic acid m.p. 239°, (Patwardhan, M.Sc. Thesis, Bom. Univ. 1938); (iv) 6-hydroxy-7-benzoyl-5- ethyl-3-methyl-coumarilic acid, m'p' 260° ; (v) 6-hydroxy-7-p-toluoyl-3-methyl-coumarilic acid, m.p. 265° ; (vi) 6-hydroxy-7-p,-toluoyl-5-ethyl-3-methyl-coumarilic acid, m.p. 260°.

The effect is more pronounced in the case of coumarilic acids having simultaneously an ethyl and an aroyl group in their 5th and 7th position respectively.

88. Synthesis of 4-Methyl-6-Ethyl-2′-(4″-Methoxy-Phenyl)-Coumarin-7:8-γ-Pyrone and 4-Methyl-7′-Ethyl-2′-Anisylidene-4′:5′-α-Pyrono-Coumaranone.

S. D. Limaye *and* M. G. Marathey.

4-Methyl -6-ethyl-7-hydroxy-8-acetyl-coumarin (Limaye and Limaye, *Rasayanam*, 1941, *1*, 201) gave on condensation with anisaldehyde (NaOH), 4-methyl-6-ethyl-7-hydroxy-coumarine-8- (p-methoxy-styryl)-ketone, m.p. 185°, $C_{22}H_{20}O_5$, (I) : acetate, m.p.155°, $C_{24}H_{22}O_6$, (II) ; benzoate, m.p.165°, $C_{29}H_{24}O_6$; methyl ether, m.p. 128°, $C_{23}H_{22}O_5$. (I) and (II) gave their dibromo derivatives m.p. 158°, $C_{22}H_{20}O_5Br_2$, (II) and m.p. 170°, $C_{24}H_{22}O_6Br_2$, (IV) respectively, both of which furnished on treatment with cold sodium hydroxide solution a compound m.p. 290°, $C_{22}H_{18}O_5$, represented as a flavone since it splits off p-methoxy acetophenone on hydrolysis with caustic alkali. On boiling (IV) with ethyl alcohol the β-ethoxy-derivative m.p. 168°, $C_{26}H_{27}O_7Br$, was obtained which on treatment with sodium hydroxide solution yielded a compound m.p.

297°, isomeric with (V) but unaffected by boiling caustic alkali under identical conditions and hence could be represented as the corresponding anisylidene-coumaranone.

89. Effect of Propylation on the Course of Hydrolysis of 7-Hydroxy-8-Acetyl-4-Methyl-Coumarin.

S. D. LIMAYE *and* K. R. CHANDORKAR, Poona.

In keeping with the observations of Limaye and Sathe (*Rasayanam*, 1936, *1* 36), on the effect of methylation on the hydrolysis of 7-hydroxy-8-acetyl-4-methyl-coumarin (I) (Limaye, *Ber*, 1932, *65*, 375) the propyl ether of (I) $C_{15}H_{16}O_4$, m.p. 102° (II) gives on hydrolysis with sodium hydroxide under different conditions two isomeric 2-hydroxy--3-acetyl-4-propyloxy-β-methyl-cinnamic acids, $C_{15}H_{18}O_5$, One of them m.p. 140° (decomp.) (III) yields on heating above its m.p. (II), with the loss of a molecule of water, while the other isomer m.p. 168° (decomp) (IV) suffers decarboxylation on similar treatment yielding 2-hydroxy-3-acetyl-4-propyloxy-isopropylene-benzene, m.p. 46°, $C_{14}H_{18}O_3$. Hence (III) and (IV) have been represented as the cis and trans stereoisomers. Methyl ether of (III) $C_{16}H_{20}O_5$, melts at 90° while that of (IV), at122°. In view of the limited number of stable coumarinic acids the isolation of (III) is significant.

90. Synthesis of 4-quinazolols.

A. B. SEN *and* M. P. UPADHYAYA

Two new 4-quinazolones, 2--methyl 3α- naphthyl-(m.p.152°C) and 2-methyl-3n-butyl (b.p.250°C at 8 mm.), have been synthesised by the action of N-acetyl anthranilic acid, primary amine and phosphorus trichloride. From these the following seven 4-quinazolols were obtained by treatment with different alkyl or aryl magnesium halides followed by decomposition with dilute sulphuric acid.

	-4-quinazolols.			Yield %	M.P. °C	Nitrogen Found	Nitrogen Actual	M.P. of acetyl derivative °C
1.	2-methyl-3αnaphthyl		4-propyl-	70.5	190	8.3	8.48	145
2.	”	”	4-phenyl-	80.3	210	7.8	7.69	145
3.	”	”	4n-butyl-	87.2	162	8.0	8.14	95
4.	”	”	4-*p*-tolyl-	66.1	172	7.19	7.4	150
5.	2-methyl-3n-butyl		4-phenyl-	85.0	165	9.4	9.52	105
6.	”	”	4-propyl-	86.7	170	10.6	10.7	—
7.	”	”	4-*p*--tolyl-	47.0	162	8.98	9.09	165

91. The action on Bacillus Coli of some mercurated phenyl ureas

KHIRODE PATNAIK *and* S. S. GUHA SIRCAR.

The object of the present investigation is to explore the antiseptic activity of a group of phynyl ureas, phenyl thioureas and their mercurated derivatives. The methods described in the literature for their prepration were compared by trials and those most suitable were employed, The mercuration was carried out in the cold by the usual methods and the 'gold-crucible' method was employed for the estimation of mercury. The Rideal-Walker 'serial dilution' method was used for comparing the activities of the products, a 24 hours' culture of B. Coli communis being used as the test organism. The following substituted ureas and thio ureas were studied.

Ph, o-, m-, & p- tolyl ; o-, m-, & p-chlorophenyl; o-, m-, and p-nitro-phenyl ; a-& b-naphthyl ; o-, m-, & p-carboxyphenyl.

92. The action on Bacillus Coli of some mercurated Phenyl Ureas.

KHIRODE PATNAIK *and* S. S. GUHA SIRCAR

13 derivatives of phenyl urea have been mercurated with mercuric acetate and the bacteriostatic action on Bacillus Coli of both the phenylureas and of their mercurated

products have been studied. In every case there is a large increase of activity on introducing the metal. The first group prevented the growth of the organism in dilutions varying from 1: 200 to 1: 700 whereas the second group did the same at dilutions varying from 1 in 19,000 to 1 in 160,000. The corresponding phenylthioureas had activities of similar order to the phenylthioureas. The mercurated compounds, however, being either too sparingly soluble, or decomposing on keeping or on warming with water, could not be investigated biologically.

93. Chemistry of β-Aryl Glutaconic Acids.

H. S. AGASKAR *and* G. R. GOGTE, Bombay.

The work of acylation of β aryl glutaconic anhydrides (Gogte : Proc. Ind. Acad. Sci. Vol. VII No.3, March 1938, p.221) has been extended to β. 1. methyoxy naphthyl.4 glutaconic anhydride (Gogte: Proc. Ind. Acad Sci Vol. I No. 1, July 1934, p.56) and the compound. c acetyl anhydride m.p. 182°was obtained.

The acylation reaction is further extended to anils obtained from different glutaconic acids, the acetylation being carried out by acetic anhydride and sodium acetate fused as well as by acetyl chloride and pyridine. In all the cases c-acetyl anils are formed. They give violet colouration with ferric chloride, titrate as monobasic acids, and are converted into original anils by hydrolysis with hydrochloric acid.

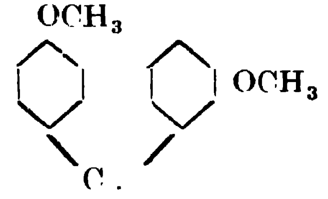
On the other hand when these anils are subjected to benzoylation, they are found to give neutral benzoyl derivatives, which also give back the original anils on hydrolysis with alkalies.

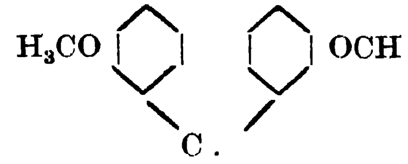
Thus anils can have both, neutral and hydroxy, structures.

94. ββ-Di-Aryl-Glutaric Acids.

G. R. GOGTE *and* V. K. ATRE, Bombay.

The constitutions of the ββ-di-(-4-hydroxy-phenyl-)-glutaric acid m.p. 234°dec, and of the ββ-di-(-4-methoxy-phenyl-glutaric acid m.p. 156° dec., have been conclusively proved by Gogte (Proc. Ind. Acad. Sci., 1935, 2A 185). Dixit and Padukone (Proc. Ind. Sci. Cong., 1948 p-30) however assigns the structure β-(-4-hydroxy-phenyl-)-β'-(-2-hydroxy-phenyl-)-glutaric acid to the first compound, which is quite untenable in view of the fact that the decarboxylation product of the ββ-di-(4-methoxy-phenyl-)-glutaric acid was found to be identical with the known αα'-di-(-4 methoxy-phenyl-)-ethylene (Gattermann, *Ber*, *22*, 1132.) To prove the point beyond doubt, we have actually synthesised the β-(-4-merhoxy-phonyl-) β'-(-methoxy-phenyl-)-glutaric acid m.p. 88° dec. (I)





and the ββdi-(-2-methxy-phenyl-)-glutaric acid m.p. 164-5° dec. (II). The structures of these compounds have been established by synthetical and analytical methods.

95. Pyronine dyes from Muconic acid.

RAM DAS TIWARI, Allahabad.

The effect of the unsaturated chromophores on the pyronine dyes has been studied before by comparing the dyes derived from succinic acid and maleic acid (Tharamdas and Tewari : Proc. Ind. Acad. Sci. 1941, *13*, 68.). In the present communication the dyes derived from adipic acid have been compared with those from muconic acid. Muconic acid was prepared from adipic acid through αα' dribromo-diethyl adipate. The acid was then condensed with various aromatic hydroxy compounds. The propoerties of the dyes were studied and their absorption maxima were determined.

96. Studies of the Dyes obtained from Acetone Dicarboxylic Acid

S. S. BAIJAL *and* J. D. TEWARI

Acetone dicarboxylic acid has been condensed with phenols, phenolic ethers, and resorcinol by Dixit, Lemaye, Pechman, and Mulay. They obtained nearly colourless compounds and they have shown that in all cases the condensation takes place in β-carbon atom. In our studies the acid is condensed with various aromatic hydroxy compounds at 180°-200°C with a few drops of concentrated Sulphuric acid as condensing agent, when bright coloured products have been obtained. The compound wth resorcinol gave deep red colour with blue fluorscence.

97. Studies on the Chromatographic method of Separation of Individual sterols from a Phytosterol Mixture from the Oil of Jute seed-Corchorus Capsularis.

N. K. SEN *and* P. R. DASGUPTA, Calcutta.

The unsaponifiable matter is separated by the method of Jameison. After evaporating off the ether the phytosterol mixture is preciptiated from methyl alcohol. Four different fractions of which three are sterols and the other is a hydrocarbon, have been separated. The white voluminous flocculent precipitate of phytosterol having its melting point at 122-125 degrees centigrade. is dissolved in ether and the solution is next chromatoghraphed through a column of Brockmann alumina (10cms × 1.5 cms). Under ordinary light the column is like,--

Top 0.5 cm. approx.	Sand colour gradually thinning into white
Middle	Three or four narrow bands of faint greenish yellow colour separated from each other by 0.5 cm.

Under ultra-violet rays the column is like,—

Top 0.5 cm.	Sand coloured fluorescence
Middle	Three or four narrow greenish yellow fluorescent bands separated from each other by 0.5 cm.
Other zone	Blue fluorescence.

Top layer of the chromatogram is removed and the rest is then eluted with ether and from the elute a fraction (A) is obtained and purified by repeated chromatography. Following are the characteristics of this fraction.

Liebermann reaction—positive; Libermann-Buchard reaction—positive; Crystalline shape-Clusters of needles when precipitated from ether; m.p.—128 degrees centigrade; m.p. of the acetate-123 degrees centigrade; forms digitonide subliming at 222-225°C

A second fraction (B) is obtained from the filtrate of chromatographic operation with the following characteristics; Libermann reaction-positive; Liebermann-Buchard reaction-positive m.p.116°C.

The coloured top layer yielded still another fraction (C) on elution with ether in very minute quantity and responding to colour reactions.

A fourth fraction (D) of semi-solid consistency metling ot 100°C and of colour light greenish yellow is obtained also from the filtrate. This is found to be a hydrocarbon after preliminary tests.

98. A bromo analogue of Paludrine.

H. L. BAMI, Delhi.

Biguanide as a basic chemical structure for the synthesis of new potential antimalarials has received considerable attention since the discovery of Paludrine. Bami *et al.* synthesised a number of substituted biguanide derivatives (*J.Indian Inst.Sci.*, 1947 *29A*. 15; 1948, *30A* 1,9; 1949 *31A*, 9) some of which when tested against experimental malarias, showed moderate antimalarial activity (Bami *et al. Current science*, 1949, *18*, 50). Various simpler analogues and isomers of paludrine were also synthesised (Bami and Guha, *Current Science*. 1948, *17*, 272) and their antimalarial screening tests revealed the exceptional potency of p-bromo-analogue of paludrine (N′-p-bromophenyl. N5–isopropyl- biguanide) (Bami *et al.*, *ibid*, 1949, *18*, 50). This potency compared favourably with that of paludrine. Improved methods for the preparation of this drug (Bromo-

guanide) have been investigated in order to prepare it in quantities sufficient for detailed pharmacological studies. A soluble lactate salt of Bromoguanide has also been prepared for injections. Further researches in the field of bromo-substituted biguanide derivatives are in progress.

99. Chlorination of Cholesterol by means of Thionyl Chloride.

(Mrs.) P. A. RAO *and* AZIZUR-RAHMAN, Aligarh.

The present authors have carried out the chlorination of cholesterol by means of thionyl chloride by Diel's and Blumeberg's methods with a view to obtain the epi form of Chloesteryl chloride, the isolation of which would help in tracing the exact step at which the Walden Inversion occurs in the synthesis of Androsterone from chlesterol.

The authors have surprisingly noted that their observations do not tally with those mentioned by the previous workers. They have invariably observed the formation of a sticky mass in the reaction mixture which is not easily manageable for crystallization. Ethyl acetate has been found to dissolve the stickly mass completely. Seeding and cooling the substance in the refrigerator yields the required crystals.

Some deviation from the previous procedure of isolation of the chloride has also been successfully attempted.

Modifications in the suitable solvent for crystallization have also been done. Crystals are obtained in two crops by acetone-alcohol mixture and ethyl acetate-alcohol mixture from the solid and sticky mass respectively, which are seperated in the reaction mixture twenty hours after chlorination.

100. On the Bromination of Cresol

N. ROY, Calcutta.

The ortho and para isomers of Cresol in a dilute solution are apt to be over brominated. A process of inhibiting this over bromination of the Cresols has been worked out, which is found to be independent of temperature as well as the concentration of bromine or acid added. A mechanism of the overbromination of Cresol and its inhibition has also been explained. This process leads to establishing an easy and accurate method of estimating cresol by bromination, the bromine equivalent of Cresol being the calculated 4.8 moles of bromine according to the theory of substitution.

101. Studies on the Component fatty acids of the Fatty Oil from the seeds of Ipomea Muricata.

ANAND LAL MISRA *and* JAMUNA DUTT TEWARI, Allahabad.

While extracting the seeds of Ipomea Muricata in connection with the studies on the glucoside from the seeds, a fatty oil in 8.4% yield was obtained. This oil had been previously examined by Kelkar, Phalnikar and Bhide (J.I.C.S., 1947, 87), but on comparison of the important constants a vast divergence was noticed. The oil was therefore carefully examined.

The mixed fatty acids were found to have palmitic (7.77%), stearic (11.43%), dihydroxy-stearic acid and another acid of m.p. 108-109°C (1%), linolenic acid (1.125%), linolic (18.54%), Oleic (58.6%), among the solid acids, the first two fractions yielded Palmitic and stearic acids but no behenic acid (m.p. 80-81°C) was obtained, as reported by previous worker. From the last fraction we have isolated an acid in small yields of molecular.-wt. 310 (Silver salt method) of m.p.135-140°C. It was subsequently identified to be dihydroxysteraric acid. The other acid got had a m.p. 108-109°C which has also been obtained by the oxidaon of glucosidic resin contained in the seeds by Singh and Tewari (Proc. Ind. science Congress 1949, 186).

The finely powdered seeds were extracted with Petroleum ether. The oil had a sap. value of 192.3 and an iodine value of 83.26. The mixed fatty acids (N.V.198.) of semi-solid consistency were separated into saturated and unsaturated acids by Pb-salt alcohol process. The percentage of solid acids (Bertram's Oxidation method) was 19.66%.

A qualitative determination of unsaturated liquid acids (N.V. 189.2 ; I.V. 130.23) was effected by $KMnO_4$ oxidation method of Hazura. By Jamieson's bromination the percentage of liq. acids comes out to be oleic 73.26% ; linolic 23.17% ; linolenic 1.406%.

The solid saturated acids (N.V. 201.7 ; I.V. 0.82) were converted into methyl esters and fractionally distilled at 32 mm. pressure and the different fractions got were hydrolysed. The component acids were palmitic, stearic and a little amount of dihydroxy stearic acid and an acid m.p. 108-109°C identical with that got by oxidation of glucosidic resin contaned in the seeds.

The unsaponifiable matter (1.09%) (m.p.-129-130°C) gave the colour reactions of a phytosterol. Its acetyl derivative has a m.p. 121-122°C.

102. Cashew Nutshell Liquid : Preliminary Investigation of the Double Bond character of the Monophenol from Commercial Raw Cashew Nutshell Liquid

V. J. PAUL, N. T. MATHEW, G. RAM MOHAN *and* LOURDU
M. YEDDANAPALLI, Madras.

The recent investigation of Wasserman and Dawson (Ind. Eng. Che., *37*, 396, 1945) and of Sletzinger and Dawson (J. Am. Chem. Soc. *68*, 345, 1946) indentified the monophenol from commercial raw cashew nutshell liquid by vacuum distillation as 3-pentadecadienyl phenol with two double bonds in the side chain, of which one was assigned the 8-9 position from the nucleus.

Our investigation is concerned with the nature of the double bonds in the side chain of the monophenol obtained from the same commercial liquid distilled at various pressures from 2 to 760 mm. Hg. The number of double bonds in the samples distilled at different pressures was evaluated by their iodine values found with thehelp ofWoburn type of iodine-bromine solution (J. D. von Mickusch and Charles Frazier, Ind. Eng. Chem. Anal. Ed. 13, 782, 1941). The 2 mm pressure distilled phenol contains 1.95 double bonds per molecule. but this number decreases with increase in the pressure of distillation, the value for the atmosheric sample is only 0.71. From these results and from oxidation products of the phenol, evidence is presented for the heterogeneity of double bonds both as to number and their relative position in the side chin. Further investigation is in progese.

103. Estimation of Cresol

N. RAY, Calcutta.

Cresol is a mixture of its three isomers being present in the proportion of o : m : p = 35 : 40 : 25. The simple theory of ortho-meta para substitution requires 4.8 moles of bromine per mole of the cresol. But owing to overbromination of some of the isomers of the cresol it has been found that 6.79 moles of bromine are actually required for one mole of Cresol. This more or less arbitarry bromine equivalent found out by the present method laid down in this paper, is based on the value of cresol estimated colorimetrically with phenol reagent as enunciated by Chapin, The colorimetric estimation of B.P. Cresols would also show that they contain only 83-87% Cresol, the rest being the moisture and other nonphenolic bodies— a fact which has been corroborated by the present method of estimation of Cresol also.

104. Thermal decomposition of Metal Alkyls: Tin and Silicon Tetramethyls.

T. V. SATHYAMURTY, S. SWAMINATHAN *and* LOURDU
M. YEDDANAPALLI, Madras.

A fairly thorough investigation of the vapour-phase thermal decomposition of aluminium trimethyl by one of us (Lourdu M. Yeddnapalli and Clarence C. Schubert, J. Chem. Phys. 13, 1, 1946) assigned a three-halves kinetic order to the process in terms of a free-radical mechanism and suggested the possibility of a similar kinetic behaviour for other metal methyl alkyl decompositions. Attempt has therefore been made to re-examine the results of the thermal decomposition of tin tetramethyl reported by Waring and Horton (J. Am. Chem. Soc. 67, 540, 1945) and to show that the results fit in better with a three—halves order rate expression and a free radical mechanism, rather than with a unimolecular rate, and a molecular rearrangement process put forward by Waring and Horton to account for the observed reaction products.

Further the experimental results reported earlier on silicon tetramethyl thermal decomposition by Helm and Mack (J. Am. Chem. Soc. 59, 60, 1937) in the low pressure region not amenable to first or second order rate expressions, have successfully been interpreted in terms of three order and a radical mechanism. The study of the kinetics of mercury dimethyl and zinc dimethyl is in progress in our laboratory.

105. Hydrolysis of Sulphonamides by Sulphuric Acid

D. D. KARVE, K. K. DOLE *and* R. D. SONATAKKE,
Poona.

Hydrolysis of the aromatic sulphonamides has been carried out at different temperatures with different concentrations of the catalysing acid. The sulphonamides investigated include,

(1) Benzene Sulphonamide
(2) p-Acetylamino-benzene Sulphonamide
(3) p-Toluene Sulphonethylamide.

Their study showed that at moderately high temperature (120° to 150°C) the hydrolysis proceeded at a measurable rate and followed the unimolecular law fairly accurately. The increase in the concentration of the catalyser acid (20N to 30N), and the increase in the temperature of the reactions (120° to 150°C) favours the reaction with a temperature co-efficient of about 2.5

The hydrolysis of p-Acetylamino benzene-Sulphonamide proceeded at a rate faster than that for p-Toluene Sulphon-ethylamide. Benzene Sulphonamide hydrolysed still faster. Thus the order of decreasing reactivity was found to be (1) Benzene Sulphonamide (2) p-Acetylamino-benzene Sulphonamide (3) p-Toluene Sulphon-ethylamide.

Biochemistry

106 On the Mechanism of the Action of Sanguinarine.

S. N. SARKAR, Calcutta.

The isolation of sanguinarine from argemone oil and its toxic effect on various enzyme systems and on albino rats were reported in an earlier communication (Nature, *162*, 265, 1948). The mechanism by which sanguinarine inactivates the pyruvate oxidiase system (which is very sensitive to -SH inhibitors) resulting in the accumulation of pyruvate in the blood of the poisoned rats has now been clearly elucidated. Sanguinarine chloride has been found to combine with one molecule of a monothiol with elimination of HCl. In the case of a dithiol (B.A.L.), a similar reaction takes place with each--SH group. This phenomenon can be readily explained by the extension of an observation made by Hope and Robinson (J., 2114, 1911) in connection with their work on cotarnine. They suggested that in a structure of type (a) R. CH:N(OH)R'R", the positive ion can combine with the negative residue of a substance H.X to form a complex of type (b) R.CH:N(X)R'R" and this being unstable passes into type (c) R.CH(X).NR'R". In the case of combination with -- SH groups, X may be represented by SR.

Now taking into consideration the toxic effects of sanguinarine observed by the author along with the results of argemone oil feeding to human volunteers by Chopra *et. al.*, Pasricha *et al.*, and Lal *et al.*, it may be said that argemone oil may produce epidemic dropsy.

107. Comparison of Adsorptive Properties of Yeast Invertase on Suitable Adsorbents.

M. M. BISWAS, Calcutta.

Comparative studies have been made of the adsorptive properties of Yeast invertase on adsorbents like activated alumina gel, bentonite, colloidal Kaolin and activated charcoal. The adsorbents were prepared and purified in the laboratory with special care. Yeast invertase has been found to be most efficiently adsorbed on activated alumina gel and the enzyme extract after elution with a buffer mixture of pH 5.4 (0.3 N acetic acid and 0.3 N NaOH) has given the maximum invertase activity.

108. Studies on Fungal Protease. Part I.

B. M. DAS *and* SUDHINDRA NATH SEN.

Studies with different fungal protease have been undertaken with the primary object of using these enzymes as bating agents for hides. Results so far obtained indicate that Aspergillus paraciticus produces stronger and stable protease than Aspergillus Oryzae. Cultures obtained from some of the isolated individual spores have yielded strains of A. paraciticus having protease activity much stronger than the mother strain. It is expected that this technique in combination with the method of electromagnetic irradiation used for increasing microbial enzymic activity would yield far stronger protease preparations.

109. Source of Nitrogen and Citric Acid Formation.

M. DAMODARAN *and* S DUTTA, Poona.

Although the production of citric acid by the fermentation of glucose and cane sugar by *Aspergillus niger* is in commercial use, it is well known that the fermentation is extremely sensitive to the raw material used as a source of sugar. As part of an investigation on the various factors in the culture medium which determine the course of the fermentation the influence of various organic sources of nitrogen especially amino-acids has been studied. The following substances were used: asparagine, aspartic acid, glutamic acid, glycine, leucine, lysine monohydrochloride, casein and egg albumin hydrolysates and urea. It was found that the nature of the nitrogen source profoundly influenced not only the growth of the fungus mat but also the amount and nature of the acid formed. With asparagine, urea and glutamic acid citric acid formation was not much lower than with ammonium nitrate (between 50 to 60%). In the case of the protein hydrolysates and aspartic acid the amount of acid formed was appreciably lowered (between 30 to 40%) and with lysine monohydrochloride it was very much lower (about 15%). With leucine acid formation was largely suppressed. Glycine was found not only to suppress acid production but also to alter the nature of the acid formed, oxalic acid being the main product of the fermentation.

110. Effect of Inhibitors of Glycolysis in Citric Acid Fermentation.

M. DAMODARAN *and* P. N. RANGACHARI, Poona.

For the elucidation of the intermediary metabolism of *Aspergillus niger* in the citric fermentation one of the crucial questions to be answered is as to the existence of glycolytic reactions. Previous investigations on this question by the use of inhibitors of glycolysis, iodoacetate and fluoride have not yielded conclusive results. The effect of iodoacetate, fluoride and phloridzin have been investigated in detail regarding their influence on the growth and metabolism of *Aspergillus niger*.

Iodoacetate added in concentrations ranging from M/400 to M/1000 to preformed mycelium of *Aspergillus niger* on a glucose medium completely inhibited both utilization of sugar by the fungus and acid formation. Fluoride at a concentration of M/150 resembled iodoacetate in suppressing both acid formation and sugar utilization but at lower concentrations, M/200, M/250 and M/300, acid formation alone was suppressed; sugar was still utilized but only at about half the rate of normal controls. Phloridzin in concentrations of M/50 and M/100 completely inhibited acid formation but did not prevent sugar utilization. At a concentration of M/150 the acid formation was reduced to 50% but sugar utilization was normal. Phloridzin in concentrations of M/10 to M/150 when used along with Currie's medium and inoculated with the fungus spore did not prevent sugar utilization but inhibited acid formation to about 30 to 50%. The uptake of inorganic phosphate from the culture medium was the same as that in the control.

111. Study on the Starches of Cereals and Pulses of Gujarat.—Part I—Physical and Chemical Properties.

C. C. SHAH *and* R. D. PATEL, Anand.

A systematic study of the starches from the cereals and puleses has been undertaken. In this part, the method of extraction and the physical and chemical properties have been dealt with. The food grains selected for the study are:—

Pisum sativum, Phaseolus Mungo, Vigna Catjung, Cajnus Cajan, Cicer Arietinum, Dolichos Lablab, Phaseolus aconitifolius, Lens esculanta, Phaseolus rabiatus, Pisum sativum var arvense, Hordeum vulgare, Triticum aestivum, Paspalum Serobiculatum, Zea Mays, Andropogon sirghum, Pennisetum glaucum, Eleusine Coracana, Oryza sativa, Setaria italica, and the properties investigated are alkali-labile value, copper number, viscosity, Nitrogen content, Phosphorus, moisture, ash and structure (Microphotographs).

112. Mode of Action of Antioxidant in Vitaminised Oil.

U. P. Basu *and* Sukhamoy Bhattacharya.

Vitamin A is an unsaturated body and is susceptible to oxidation. Highly oxidised vitamin A has no biological activity and as such if the inherent cause and mode of oxidation be known, it would be much easier to control the deterioration of vitamin A in any vitaminised oil preparation. The autoxidation of fat is now believed to be due to the formation of a free radical by detachment of an alpha methylenic hydrogen ion (*cf.* Farmer, *Trans. Farad. Soc.*, 1946, *42*, 228). If the vitamin molecule behaves in such a way, then nature of diluent would play a secondary part and the hydroxy phenolic antioxidant by preventing the formation of hydro-peroxide would protect the vitamin from deterioration. Under such circumstances and according to the observations of Calkins (*J. Amer. Chem. Soc.*, 1947, *69*, 384) an acid inhibitor by donating proton would further help in regenerating the hydroxy antioxidant that is being bound up by the unsaturated complex of the vitamin molecule, and thereby help in preventing the formation of peroxide by the unsaturated complex.

Experimental observations are being recorded to justify the mode of action of the antioxidant in retarding the onset of oxidation in V tamin A.

113. Nutritive value of Some Local Food Stuffs.

M. N. Rudra, Darbhanga.

The protein contents and vitamin C contents of some local foodstuffs have been investigated and found to be higher in the case of some articles than the values reported from other areas.

114. Methionine Estimation in Foodstuffs.

M. N. Rudra *and* L. M. Choudhary, Darbhanga.

Csonka and Denton's method of estimating methionine colorimetrically has been modified and improved. The modified method gives trouble-free manipulations and excellent results. Estimated by this method khesari dal, rice and mung dal have been found to contain 0.06, 0.21 and 0.28 percent of methionine respectively. We think this extremely low methionine content of khesari is one of the etiological factors in lathyrism.

115. Studies on Experimental Diabetes.—Part I—Effect of Aceto-acetate on the Glucose Tolerance and Glycogen Storage in Rabbits and the Comparative Effects of Insulin and Amellin on such Animals.

M. C. Nath *and* C. H. Chakrabarti, Nagpur.

1. Continuous injection of sodium acetoacetate with increased doses beginning from 50 mg/kg body weight, causes progressive hyperglycemia in rabbits after an initial hypoglycemic stage.

2. Glucose tolerance of these animals is reduced considerably after 30 days of injection. The glucose tolerance curves taken after 30, 50, 70, 90, 110, 130, days showed progressive development of diabetic tolerance.

3. Glycogen contents of liver and muscle get gradually depleted, the percentage depletion after 130 days of injection being 64.9 and 73.4 respectively.

4. One of the treated animals excretes glucose in urine after 175 days of injection. The percentage of glucose in urine of 24 hours sample is 0.8.

5. Amellin, when injected in the daily dose of 10 mg/kg. to the hyperglycemic animals for 40 days is found to reduce the blood sugar to 105 (normal value) from 171 mg per 100 c.c. blood, whereas insulin reduces the blood sugar of the treated animals to 182 from 186 mg per 100 c.c. Insulin is found to relieve hyperglycemia initially. After 20 days the animals behaved as insulin refractory cases. Increase in dose would lead to death of the animals.

6. Glucose tolerance of the animals treated with sodium acetoacetate becomes absolutely normal after amellin administration for 40 days, whereas the glucose tolerance of the similarly treated is different.

116. Indian Tea—Its Mineral and Other Contents.

S. K. Chatterjee *and* H. D. Ganguli, Calcutta.

Tea is used a common beverage all over the world, its stimulating effect is said to be due to the presence of caffeine (2%–3.5%) in it.

Tea is the dried leaves and buds of different species of Thea (genus Camellia). The greater portion of the tea is supplied from India, Ceylon, China and Java. The varities of the tea depend upon the age of the leaves at the time of picking them and upon the different methods of preparation. The quality of the tea is judged by expert tea tasters by tasting the infusions prepared from the tea leaves. But as adulterations are quite common it is necessary that we should depend upon some chemical tests for detection of the purity of the stuff. In the food adulteration Act there are three main datas, which one has to fall back upon. They are (1) the percentage of ash (4%–8%) (2) the proportion of this ash which is soluble in boiling distilled water (not less than 40%) and (3) the amount of soluble matter extracted from the leaf by boiling water (not less than 30%). It is interesting to note that neither caffeine nor tannin, the important constituents of tea plant, have been included in it.

Another important feature is the presence of manganese in the fragements of tea and in a fairly high proportion than any other plant products.

The common adulterants of tea leaves may be of mineral type, organic type, colouring matter or of astringent type. A skilful hand can mix any of these adulterants to a sample of tea without being detected under the food adulteration Act. The microscopic examination may be suspicious but the analytical figures will fall within the range of limits of those of the Act.

Under the circumstances it becomes necessary that the caffeine and the manganese contents of the leaves should also be determined to give a definite opinion as to its adulteration.

With this important aspect in view several samples of tea available in the Calcutta market have been analysed and the average caffeine and manganese contents there-of have been determined. It was also noted that the leaves possess a trace of Vitamin B but no Vitamin C in them. Green tea however contained 1 mg percent of Vit B_1 and a minute trace of Vit. C.

The results of analysis have been given in a tabular form with an account of the methods adopted in each case. The average value of the results in each case is given below.

Tea	Moisture	Ash	Manganese	Caffeine	Vitamin B_1	Vitamin C
Darjeeling	5.71	5.58	0.01779	4.142	Traces	Nil
Terai	5.43	5.71	0.01799	3.499	Traces	Nil
Dooars	5.02	5.38	0.011719	4.487	Traces	Nil
Sylhet	4.88	6.16	0.0562	3.366	Traces	Nil
Cachar	4.91	6.03	0.0540	3.197	Traces	Nil
Assam	4.96	6.36	0.1130	3.864	Traces	Nil
Green tea	6.50	7.01	0.0515	4.42	1 mg percen cent.	Minute traces.

117. Investigation on the use of Ice-containing Preservatives for the Preservation of Perishable Food-Stuff (fish).

A. N. Bose *and* K. P. Kolay, Calcutta.

Incorporation of sodium hypochlorite or sodium benzoate in ice, reduces the amount of ice needed to keep fish in fresh state during transport and storage, and increases the keeping quality of fish. While fish (Cyprinus Carpio) stored in ordinary ice will be

inedible in 18 hours, it will remain practically fresh for 48 hours in the same amount of ice with 0.1% sodium hypochlorite or 0.8% of sodium benzoate. Highest concentration of preservative that can be incorporated in ice is limited by its penetration in the fish-tissue and by the alteration of flavour it causes. Maximum concentration of 0.1% of sodium hypochlorite or 0.8% of sodium benzoate can be used without affecting the taste of flavour. Sodium hypochlorite is better of the two preservatives as regards their action on mico-organism E. Coli.

Industrial Chemistry

118. Cellulose Ethers and Their Fractionation.

HITENDRA BHUSAN ROY, SADHAN BASU *and* SANTI R. PALIT.

It is difficult to fractionate cellulose ethers into a large number of fractions in order to get a complete view of the nature of molecular weight distribution curve, owing to the fact that lower cellulose ethers are highly soluble in water and the higher ones are soluble in almost all common organic solvents. It is known that cellulose dibenzyl ethers are soluble in a limited number of organic solvents and mixed solvents, and are completely insoluble in alcohols, higher hydrocarbons, ethers, etc. It is expected, therefore, that dibenzyl cellulose may be fractionated into a large number of fractions and an insight may be obtained into the nature of the distribution curve of the cellulose ether.

With a view to this, dibenzyl cellulose was prepared from Doria cotton of Bombay by the modified method reported in a separate abstract. One per cent solution of the ether in chloroform was fractionally precipitated with ethyl alcohol. When about 150 cc. of alcohol had been added per cc. of chloroform to the solution, rest of the ether was fractionated by precipitation with water. The result is given in the following table:

The figures in the last column give the values of intrinsic viscosity from which a differential and integral viscosity distribution curve can be easily constructed. It can be easily seen that the differential curve contains two humps, which is not unusual in such compounds. Since the Staudinger's constant for benzyl cellulose is not known, the calculation of molecular weight for various fractions was not possible. However, work on osmotic pressure measurements on these samples is in progress from which the D.P. will be evaluated and correlated with [η].

TABLE

25 cc. of 1.1% solution in chloroform of dibenzyl cellulose.

Fractions.	Amount of Precipitant.	gms. of Precipitate.	Intrinsic visco sity in chloroform.
I.	60 cc. EtOH	.1960	0.69
II.	+ 15 cc. ,,	.1848	0.40
III.	+ 20 cc. ,,	.1334	0.28
IV.	+ 25 cc. ,,	.0640	0.24
V.	+ 50 cc. ,,	0.500	0.17
VI. (concentrated to 5 cc).	+ 50 cc. ,,	.1000	0.14
VII. (concentrated to 2cc).	+ 75 cc. ,, and 5 cc. water	.1440	0.12
VIII.	+ 70 cc. water.	.1374	0.07
IX.	evaporated to dryness.	.0550	0.05

119. Modified Laboratory Method for the Preparation of Benzyl Cellulose from Cotton.

HITENDRA BHUSAN ROY *and* SADHAN BASU.

Doree's method of preparation of benzyl ether of cellulose gives a very poor yield of the dibenzyl ether when applied to the case of cotton cellulose. Consequently, the method was modified for the preparation of dibenzyl ether from Doria cotton of Bombay. The sodio-cellulose was prepared by treating the cotton with 20 to 30 per cent sodium hydroxide solution. The sodio-cellulose was then reacted with benzyl chloride under reflux. The process was repeated three times and finally the benzyl ether was washed, steam distilled and dried at 100° to 105°C. This method not only increases the yield from 5 to 55% but also cuts down the time of reaction by about 24 hours.

120. Hydrolysis of Starch.

M. Goswami *and* M. Bhowmik.

Great difficulties are to be overcome to carry out the simple reaction of adding one molecule of water to one molecule of cellulose or starch, on a plant scale in all existing processes of wet hydrolysis.

Following the new trend in the use of sulphur dioxide (as sulphurous acid) to convert starch into glucose as also in the use of hydrogen chloride gas in the dextrinisation of starch, we started our work on the saccharification of corn starch by investigating the effect of hydrogen chloride gas at various temperatures (D—100°C) and obtained a maximum conversion of 54% of reducing sugars (in terms of glucose). The use of additional catalysts like $CaCl_2$, $ZnCl_2$ etc. inhibits caramelisation of the product to a great extent. NO_2 and Cl_2 (0—80°C) give a maximum conversion of 30% of reducing sugars (in terms of glucose). The effect of inert gases like CO_2 together with hydrogen chloride gas on the rate of conversion was only appreciable at high temperature.

The exothermic reactions between hydrogen chloride gas and starch or cellulose has been very much facilitated by using organic solvents like carbon tetra-chloride benzene, chloroform and from a suspension of starch (20-30% moisture) in these solvents a maximum recovery of glucose of practically 100% has been obtained under normal conditions of temperature and pressure. Concentrated hydrochloric acid also gives similar results. The effect of temperature (50–70°C) on the rate of conversion is termendous in the latter case.

The remnant of acid may be removed by heating the suspension of product in high boiling liquid like decalin or by bringing the liquid product of acid conversion of dextrose polymer in contact with resinous reactions of formaldehyde and m-phenylene diamine or other amine of the general formula RNX or by distilling the product in vacuo and subsequent spray drying.

121. Electro-Deposition of Manganese.

B. N. Ananthan *and* S. Husain, Hyderabad-Deccan.

A systematic study of the electro-deposition of manganese was undertaken. It was found that the addition of ammonium sulphate to manganese sulphate solutions facilitated the deposition of manganese. The brightness of the deposits obtained was enhanced by the addition of triammonium citrate to the manganese sulphate-ammonium sulphate baths, the deposits obtained being very thin. As against the sulphate baths, the citrate baths were free from slime, the addition of citrate preventing the anodic oxidation manganese ions. It was, however, found that the yield in the case of the citrate baths was very poor, which as the potential measurements indicated, was due to the cathodic potential becoming more negative.

122. Investigation of the Possibilities of the Manufacture of Calcium Carbide and Bleaching Powder from Hyderabad Lime Stone.

D. S. Datar *and* S. Husain Zaheer, Hyderabad-Deccan.

Though the raw materials used in the manufacture of Calcium Carbide occur in abundance, further enquiry has shown that they are not of the requisite quality. They contain magnesium oxide and silica in prohibitive quantities. It is estimated that more than 25% of power will be consumed due to interactions of these impurities and the product will be excessively impure. Lime stone available in the State contains 1-2% of magnesia and 10-30% of silica and is also not suitable for the bleaching powder manufacture. Experiments conducted for the mechanical separation of silica from lime stone taking recourse to the elutriation and size separation were of no avail. It is shown that the carbide or bleaching powder industry have no prospects in the Hyderabad State.

123. Cryoscopic Studies in Thermal and Oxidative Polymerization of Semi-Drying Oils.

K. K. DOLE *and* N. R. APHALE, Poona.

Thermal polymerization of Arachis, Niger seed, Sesame and Safflower seed has been studied by heating the oils in an inert atmosphere at different temperatures and different periods. Oxidative polymerization of these oils has also been studied by heating them at the same temperatures and periods but in presence of a current of dry air. Iodine value, refractive indices and molecular weights are determined in each case. The molecular weights are determined by cryoscopic methods in benzene. Molecular weight increase in oxidative polymerization is always more than in thermal polymerization. Refractive indices are increasing with increase in polymerization and are approximately proportional to the increase in the molecular weights. Iodine values naturally decrease but no correlation exists in the iodine values and the corresponding molecular weights. It seems that some correlation may seem to exist if the study is extended to longer ranges of temperature and time of heat treatment.

124. Studies in the Preparation of Aluminium Solder.

D. R. DHINGRA, G. N. GUPTA *and* M. G. GUPTA, Kanpur.

Since the introduction of aluminium as an important engineering material, much time and energy have been spent in developing methods for making joints of the metal and its alloys. At the present time the usual methods employed in practice are oxy-gas welding and soldering. Inspite of the extensive research-work as yet no solder has been discovered which would make permanent joints and could stand long exposures to moist atmospheres.

Detailed investigations were made to prepare an aluminium solder which would make strong joint and have minimum electrolytic action. As a result of these experiments it has been possible to prepare an aluminium solder which works smoothly, has a melting point of about 320°C and produces end to end joints which could bear a stress up to 7.5 lbs. sq. in. This is an improvement over one of the best foreign solders the end to end joint with which could bear a stress only upto 7.1 lbs. sq. in.

This solder did not require any flux, the joint could stand corrosion in 10% salt solution for more than two months and remained unaffected in boiling water for more 60 hours. The composition of this solder is as follows:—

$$Al = 6.5\%, Sn = 47.5\% \text{ and } Zn = 46.0\%.$$

125. Organolite from Indian Tannins.

M. S. BHATNAGAR *and* B. P. SINGH, Kanpur.

The present work was undertaken to prepare ion exchangers from cutch which is largely available. Analysis of various samples of cutch was carried out and they were found to contain about 8% insoluble matter. This was removed and the rest was resinified. The following results were obtained.

1. It did not adsorb strong acids.
2. It gave colour with strong alkalies.
3. The adsoprtion of calcium, barium, strontium was studied.
4. The adsorption of $Ca(OH)_2$, $CaCl_2$, $MgCl_2$, $MgSO_4$ was also studied.

It was observed that calcium was adsorbed more as hydroxide than as chloride and magnesium was adsorbed more as sulphate than as chloride.

126. Production of Saltpeter in the Hyderabad State.

D. S. DATAR, Hyderbad-Deccan.

Saltpeter as a natural mineral deposit does not occur in the state. It is, however, manufactured in certain villages in the south western part of the state from the earth taken under old refuse heaps. The earth containing on an average 3-5% of potassium nitrate is extracted with water. About 40-50 tons of shora are produced annually.

A sample of shora or crude saltpeter from Gulbarga District contained 70.5% potassium nitrate and 26.7% sodium chloride. The crude material can be refined by throwing it into a boiling saturated solution of sodium chloride. The refined salt contianed 95% potassium nitrate. Common salt is a bye product.

127. A note on the Development of the Potash Production in Hyderabad.

D. S. DATAR *and* S. HUSAIN ZAHEER, Hyderabad-Dn.

Potassium salts are valuable fertilizers. The present production of potassium salts in the Hyderabad State is meagre. A few tons of saltpeter are recovered from the earth taken from under old village refuse in certain localities, which are utilized locally for making fireworks The other potash bearing minerals existing in the state are felspar and waste mica. Economic methods for the recovery of potash from them are under investigation. The other important source of potash is the waste materials in certain industries, which contain considerable amount of potash. It is estimated that annually about 300 tons may be recovered from the waste from the manufacture of alcohol and about 800 tons from the fine dust in the cement industry. The fine flue dust is now allowed to escape to the atmosphere. The cement factory will have to fit up the necessary equipment for the collection of the fine dust. The another source of potash is wool yolk obtained by washing raw wool. This is estimated to yield about 50-100 tons of potash annually. The other sources of potash are the waste from the tobacco industry, cotton hull ash and wood and kitchen ashes, which are used directly as fertilizers. The utilization of these potash bearing ashes and other village refuse as fertiliszrs should be organised on rational and standardised basis. The recovery of potash from industrial wastes and other potash bearing materials must receive our immediate attention to enable us to cope up with the demand for the potash fertilizers.

128. Development of the Salt Industry in Raichur and Gulbarga District.

D. S. DATAR, Hyderabad-Dn.

Edible salt is made in the western districts of the Hyderabad Sta e from salt earth and brine from wells. The salt when contaminated with sodium sulphate and magnesium sulphate is known as tannery salt as it is used for preserving raw hides and skins. This is better and unfit for human consumption and is sold at cheaper rates. A process has been developed for the recovery of the different salts in the tannery salt. which consists of (1) the precipitation of magnesium as basic magnesium carbonate, (2) freeing of sodium sulphate from boiling solution taking advantage of the lower solubility of sodium sulphate at higher temperature and (3) separation of sodium chloride by throwing tannery salt into the solution made saturated with respect to sodium chloride after removal of magnesium and sodium sulphate. This solution can take up more sodium sulphate and magnesium sulphate but throws out sodium chloride. The basic magnesium carbonate may be converted into magnesium sulphate by heating it at about 300°C with coal pyrites. It is estimated that more than 400 tons of table salt and 150 tons each of sodium sulphate and magnesium sulphate can be recovered from the tannery salt.

A mixture of sodium chloride and sodium sulphate, which is obtained after removal of magnesium from tannery salt, may be used in the hydrochloric acid industry in the State to replace the imported common salt.

129. Durability of Soda-Lime-Silicate Glasses.—Part V.

A. CHOWDHURY (Calcutta) *and* H. N. DAS-GUPTA, Dhanbad.

A Study of the effect of Ultra-Violet radiations of both long and short wave lengths on chemical durability of glass has been made. It has been found that these exposures bring about changes in the constitution of glass. The alkali ions are the most loosely bound units of glass structure, and the change, referred to above, relates to a general strengthening of such bonds. This results in an increased durability of the glass. Thus, if the chemical resistivity of the bulk of the glass be determined by using a "powder method", the Chilled glasses show distinctly lower resistivities than the same glasses after exposure. In this respect the effect appears to be analogous to that of annealing.

130. Recovery of Sulphur from Copper Pyrites.

M. R. **Basu** *and* H. N. **Das Gupta**, Dhanbad.

Results of preliminary laboratory experiments suggest the possibility of recovering the sulphur from copper pyrites, either as the element, or in the form of ammonium compounds. The process too appears to be a simple one. This consists in evolving the sulphur as sulphuretted hydrogen, or as a mixture of sulphuretted hydrogen and sulphur dioxide, and contacting the evolved gas or the gaseous mixture with oxides of nitrogen. In the former case immediate deposition of sulphur takes place, and, in the latter case a mixture of ammonium sulphate and sulphite is produced.

131. Glasses Containing High Percentage of Phosphoric Anhydride.

P. D. **Swami**, Bikaner.

The aim of the present investigation was to study the various phosphate glasses as regards their deformation temperatures and to find, if possible, some suitable composition containing as high a percentage of phosphoric anhydride as practicable and maturing at 1650°F. which can be used as a ground coat enamel on steel.

Ortho-phosphoric acid was used with some difficulty as a source of phosphoric anhydride, but mono-ammonium dihydrogen phosphate was found to be much more satisfactory.

Fifty-two compositions were studied and the deformation temperatures of the resulting glasses determined.

It was found that excess of phosphoric anhydride and lithium oxide in the glass causes bloating in button tests; furthermore, the excess of phosphoric anhydride renders the glass unstable and thus unsuitable for use as enamel. Substitution of barium oxide for phosphoric anhydride eliminated bloating.

Composition which most nearly meets the object of this investigation is as follows:

20% P_2O_5; 25% SiO_2; 15% B_2O_3; 6% CaF_2; 20% BaO; 5% Al_2O_3; 5% K_2O; 1% Co_3O_4; 1% NiO; and 2% MnO_2.

The enamel having this composition deformed at 1650°F without any bloating. It is promising for use as ground coat enamel for steel. Preliminary tests showed, however, chipping and crazing when fired.

132. Utilization of Hyderabad Coal Pyrites. Part I. Preparation of Calcium Hydrosulphide and Sodium Sulphide.

D. S. **Datar**, Hyderabad-Deccan.

Calcium hydrosulphide and ferrous sulphate are the two valuable and useful products obtained when the following process is employed:—

i) $FeS_2 + CaO + C \rightarrow \xrightarrow[\text{3 hours}]{600\text{-}800^\circ C} FeS + CaS + CO$

(ii) $\dfrac{FeS + CaS}{\text{from (i)}} + \dfrac{H\ S}{\text{from (iii)}} \rightarrow Ca(HS)_2 + FeS$

iii) $\dfrac{FeS}{\text{from (ii)}} + H_2SO_4 \rightarrow FeSO_4 + H_2S$

The yield is over 90%

Sodium sulphide is produced by the reaction between iron pyrites and sodium carbonate in presence of coal. The yield is 32% when equimolar quantities are used. The yield is 60% when the mixtures of iron pyrites and sodium carbonate in the molar proportion of 1: 2 or 1 : 4 are heated at 900°C for 3 hours.

133. Utilization of Hyderabad Pyrites. Part II. Preparationof Sulphates.

K. N. **Moorthy**, D. S. **Datar** *and* S. **Husain Zaheer**, Hyderabad-Deccan.

Reaction of iron pyrites with metallic oxides and carbonates have been employed in the preparation of the sulphates. Good yields have been obtained in the case of magnesium sulphate, sodium sulphate and manganous sulphate. Investigation is also in progress on the preparation of sodium sulphate from sodium chloride by a modified Hargreaves' Process.

134. Refrigeration in Aid of Steel Industry.

J. R. Basu Mallik.

In this paper, the author has reviewed the results obtained by the use of oxygen-rich air in the iron and steel industry.

In the first part, the author has described the various methods of liquefying air and the subsequent production of gaseous oxygen from the liquid air.

In the second part, the author has shown the results obtained by the use of oxygen rich blast in the production of pig iron. The experiments carried in foreign countries indicate the possibility of utilising the low grade ore and coal economically. The greater output and saving in coke consumption, justify the capital expenditure for the production of gaseous oxygen

Results of the use of oxygen—rich air in the production of steel are also very encouraging. The main advantages are:—1) Greater output. 2) Better grade steel. 3) Use of larger percentage of scrap.

135. A New Type of Grinding Aid in Disintegrations of Solids.

K. K. Mazumdar, Dhanbad.

A new type of grinding aid has been found very efficient in grinding tough substances, e.g. flaky graphite. They are minerals of great hardness and high magnetic permeability e.g. ilmenite, magnetite, rutile, etc. and afford ready means of separation from the material ground by an electro-magnet from suspension in water. They form a distinct class and their uses for the above purposes have not yet been reported.

136. Influence of Physico-Chemical Properties of Brick-Earths on Fired Bricks.

N. K. Patwardhan, Roorkee.

As a result of an exhaustive study undertaken at the Building Research Unit (C.S.I.R.), Roorkee (U.P.), on the Physico-Chemical properties of Bricks Earths and Bricks from different parts of India some useful information has been collected. It has been found that on acount of heterogenity of brick earths the study has to be carried out on the same lines as in the case of agricultural studies on soils. The result in order to be of any practical value ought to be statistically examined. Of the many properties studied it appears that the mechanical composition, firing temperature and the presence of fluxes in the earths influence the finished bricks considerably. The geological age of the deposits is of great importance and as a general rule it can be said that those of recent geological age give good products.

137. Beneficiation of Low Grade Manganese Ores.

K. K. Majumdar, Dhanbad.

Manganese ores from Gadshanker mines, Patna State, having the composition (Insoluble 14.17%, Mn 30.61%, Ba 1.00%, Fe 26.80%) were subjected to sink and float operation without success. It was also not possible to improve the grade by froth flotation with oleic acid and pine oil at pH 4 to 6 and also with Na-oleate and pine oil at pH 8 to 9.

138. Beneficiation of Lead-Zinc Ore from Zawar, Rajputana.

K. K. Majumdar, Dhanbad.

Lead-zinc ore from Zawar, Rajputana, responds excellently to sink and float process, thus making it possible to discard a large amount of gangue, in the coarse state. Results obtained with the average run-of-mine ore are as follows ;—composition of run-of-mine ore, insolubles 19.92%, Pb 12.60%, Zn 10.23% ; size of ore particles-$\frac{1}{4}$-10 mesh ; yield

55%; composition of concentrate, insoluble 9.48%, Pb 9.55%, Zn 16.34%; recovery Pb 86.06%, Zn 93.10%.

139. Determination of Chlorine Linked to Organic Compounds in Coal.

J. N. Chakrabarti, K. K. Majumdar *and* H. N. Das Gupta, Dhanbad.

It has been found that Meulen's method (Rec. trav. Chim., 1928, *47*, 698) is quite suitable for estimating the percentage of chlorine, linked to organic compounds, in coal.

140. Simultaneous Determinations of Total Chlorine, Nitrogen and Phosphorus in Coal.

J. N. Chakrabarti, K. K. Majumdar *and* H. N. Das gupta, Dhanbad.

The department of Scientific and Industrial Research, Lond., has recommended standard methods of analysis of Coal and Coke for its Fuel Research Station. In fact, these methods have got wide popularity. It appears, however, that some of these methods are time consuming and are not beyond criticism. Thus, for each ingredient a separate experiment has got to be made. The determination of Chlorine entails a period of 25-26 hrs. Again, in the determination of phosphorus in Coal, the latter has got to be exposed to a temperature of 775°+250°C to get its ash. The ash thus obtained is used for phosphorus determination. In this case an assumption has been made that no phosphorus is volatilised during the preparation of ash. Conditions favourable for expulsion of phosphorus are prevalent during ash formation and, as such, there can hardly be any justification for the above assumption.

A new method has been envolved for estimating the percentage of chlorine, phosphorus and nitrogen in Coal. This consists in subjecting coal to moist combustion, when both chlorine and phosphorus are completely expelled from their original combinations. The evolved products are quantitatively absorbed in a solution of sodium hydroxide, containing an equl volume of hydrogen peroxide. The resulting solution is then utilised for determining the proportions of chlorine and phosphorus. The nitrogen of Coal remains in the digestion vessel and a measure of which is easily obtained by expelling it as ammonia. The total digestion period is between 50 and 55 minutes. The process also offers additional advantage of determining the ingredients of coal ash in the same set of experiments.

141. A Comparative Study of the Methods for Determining Unsaturation in Drying Oils with Particular Reference to Conjugated Double-Bonds.

S. M. Das Gupta *and* R. C. Das Gupta, Delhi.

During recent years, when drying oils containing conjugated double bonds, either natural or artificial, have found increasing applications in protective coatings on account of their capability of undergoing the Diels-Alder reaction, it has been engaging the attention of the chemists to find out a reliable method for the determination of such unsaturation. In this paper, a comparative study of the current methods for determining unsaturation in drying oils with particular reference to conjugated double bonds, has been made under the same conditions. Four methods were selected : (1) Wijs' (partial iodine absorption method) ; (2). Hoffmann and Green's modification of the standard Wijs; (3). Kaufmann bromometric method ; (4). Woburn method. The experimental results obtained led to the following conclusions : (1) In the case of non-conjugated oils, Wijs, Hoffmann's modification of Wijs', Kaufmann, and Woburn methods give an increasing order of iodine values ; (2) In the case of conjugated systems, the Woburn method gives much higher figures than the Wijs', Kaufman figures lie in-between these two methos; (3) The difference between the iodine values obtained by the Woburn and Wijs methods is an approximate measure of the diene value ; (4) safflower and menhaden oils which are at present believed to be non-conjugated oils, also contain small amount of conjugated fatty acids ; (5) although the naturally accurring conjugated tung oil gives almost the theoretical maleic anhydride number, the artificially made conjugated oils g ve low figures. The type of conjugation in these latter oils either exists in a pseudo form or offers some steric hindrance to the Diels-Alder type of reaction.

142. A Review of a Method for the Evaluation of Paint Films Under Various Weathering Conditions.

S. M. Das Gupta *and* K. K. Puri, Delhi.

The final rating of an organic film from a study of its outside exposures under various weathering conditions such as light, humidity, and temperature changes, is an important problem for the paint industry. It is also important from the view point of national economy. The subject, however, is complicated as it involves several factors. In this paper, a method is suggested which may be of value in correlating different types of failures by one single all-inclusive figure. After careful scrutiny, paint faliures have been classified into six groups and indicated by 0, 2, 4, 6, 8, 10, according to the degree of failure. 10 indicates perfect and zero (0) indicates complete failure. Photographic pictures of degrees of failures of each type have been published by the Federation of Paint & Varnish Production Clubs (U.S.A.). With the help of these pictures, film can be compared for various types of failures such as checking, cracking, peeling etc., and quantitative values assigned for each type of failure. The final assessment of the paint film by one single figure may then be made with the help of a nomograph designed by Garlock & McMullen.

143. Analysis of Vanaspati imported to Orissa.

D. Mishra, Orissa.

Most of the people in Orissa believe in genuine ghee and genuine oil but not in Vanaspaties. Some of the Vansapaties imported here are utilized in adulteration of ghee due to the mal-practice of the ghee dealers. In comparison to ghee the consumption of Vanaspaties is much less in Orissa. The total output of ghee in Orissa is 95,000 maunds and the total import of Vanaspaties in 1946-47 was 5,000 maunds and in 1947-48 was 6,000 maunds. The following Vanspaties are imported to Orissa—a) Dalda, b) Rasoi, c) Rakav, d) I.V.P., e) Bansada, f) Kusum Product, g) Lion brand, h) Krishna brand, i) Lakshmi brand, j) Kamdhenu. The Department of Food, Government of India, in their notification dated 31st January, 1947 gave the specification for Vanaspati. It was formerly thought to be akin to Margarine and the probable constituents were as given in proceedings, Indian Science Congress, 36th. abstract, p. 91-178. But qualitative tests and a few chemical tests clearly show that most of them contain Cocoanut, groundnut, Cottonseed and Sesame oils. But some of them correspond to the values of Mahua oil. Out of all the Vanaspaties b) Rosoi, c) Rakav, d) I.V.P. e) Bansada, f) Kusum products, g) Lion brand were analysed and found almost akin to Dalda Vanaspati according to the experimental results given in orginial paper.

144. Grit in Atta and Flour—Utility of Carbon tetrachloride Test.

S. K. Bhattacharyya *and* S. N. Mitra.

In routine examination of atta and flour it was observed that presence of excessive extraneous grit and sand made these otherwise fit commodities physically unfit for consumption, apart from their being injurious. As a large number of samples were daily examined, we felt the necessity for a rapid test for detecting extraneous sandy matter and to fix its upper limit in atta and flour.

"Ash%" alone could not afford definite conclusion as samples having normal ash contents had, not infrequently, too high a percentage of grit. For initial rapid sorting carbon tetrachloride was used to cause the sample to float on top and to throw down the sandy matter at the bottom. If the amount of the latter was appreciable, estimation of "Sand or Siliceous Matter" was done.

From a large number of such analyses we were able to fix the upper limit for extraneous sandy matter which would be 0.25% for atta and 0.20% for flour. Beyond these limits the grit "tells between the teeth", more so as its amount increases. Use of carbon tetrachloride was further extended to detect and identify mineral additions in self-raising flours.

145. A New Volumetric Method for the Estimation of Citric Acid.

D. S. Datar *and* V. D. Thatte, Hyderabad-Dn.

The reaction between Potassium permanganate and Citric Acid in presence of Sulphuric Acid is induced by Ferrous Sulphate. This reaction has been employed for the determination of the strength of Citric Acid. This is done by titrating it against Potassium permanganate in the presence of acidified Ferrous sulphate,

146. Oil-Base Drilling Fluid.

S. N. BISWAS *and* N. C. SEN GUPTA, Digboi.

In rotary drilling of oil-wells a fluid, generally a suspension of clay in water, is circulated through the dril-pipes carrying the rock cutting to the surface. Water-base muds have, however, the disadvantage that water is filtered from the mud into the porous rocks. This water reduces the permeability of the sand to oil and, in certain circumstances, may entirely prevent flow of oil into the well. Oil-base muds are now being used where there is likelihood of loss of production due to this effect of water. For the past year chemists of the Assam Oil Co. have been conducting experiments on the preparation of Oil-base muds from local products. A practical trial using oil-base muds has recently been made in one well to drill through low pressure oil sands; the production obtained was markedly better than estimates for wells using water-base muds. The viscosity and other desirable characteristics of the fluid were controlled by adding to the oil requisite amounts of blown bitumen, a vegetable oil and caustic soda. Specific gravity of the fluid was increased to the desired value, by adding finely ground barytes. Laboratory experiments are being continued to use a loading material lighter than barytes.

147. A New Oxidising Agent for the Bleaching of Textiles.

B. R. WALAVALKER, P. R. BAVDEKAR *and* R. P. DAROGA.

The present paper is limited to a summarised presentation of the properties of the new product, calcium chlorite $Ca(ClO_2)_2$, in order to indicate or suggest its unique adaptability to many industrial uses. Calcium chlorite has very high oxidising power to destroy all the colouring matter associated with cotton fibre but it is not powerful enough to attack the fibres themselves.

Further research work carried out during the past year by the Research Department of Tata Chemicals Limited has shown that excellent results are obtained, without altering ordinary bleaching procedures in any particular way, if a mixture of calcium chlorite and hypochlorite in an alkaline solution is used in the place of straight hypochlorite. The bleaching action of this mixture is that of chlorine-dioxide (ClO_2) and not of hypochlorite. The results show that the cloth is bleached faster and somewhat better white colour is obtained than ordinary straight bleaching. When the mixture is used, only from one-half to two-thirds of the total available chlorine used in the straight hypochlorite bleaching is required.

148. Inducing Flowering in Mango by Ringing the Bark.

P. C. MALLIK, Sabour.

To determine how far ringing can induce flowering in mango and whether the treatment can be used as an orchard practice to encourage blossoming in the 'off' years, experiments have been conducted at Station. It has been seen that ringing the main branches can induce floworing in 'off' years and increased flowering in 'on' years, in young and older trees alike. Trunk ringing is detrimental even when applied in two halves. Ringing the branches in early August is better than mid-August or early-September treatments.

Out of the three widths, viz., ¼", ½" and ¾" employed, ½" ringing is most effective; ¾" is injurious as the wounds do not heal up for along time, and do not give the desired effect while ¼" rings heal up before the effect is fully achieved. Half inch rings however show an adverse effect on certain percentage of ringed branches but this can be successfully averted by manuring the reated plants with F.Y.M. Am. Sulph. immediately after the treatment. The various effect were more pronounced in the 'off' years than in the 'on' years when the results are partially masked. Ringing in successive years can be practised with advantage. Effcet of ringing is immediate during the next bloom and no residual effect remains in the year following. Shy bearers could easily be forced to bear by ringing even earlier.

149. Fixation of Nitrogen by Vegetable Oils.

S. A. SALETORE *and* V. N. GAVAI.

Samples of groundnut oil, whether raw, refined or bleached, when exposed to the air for long periods of time under room conditions have been found to show an increase in their nitrogen content. Accelerated tests carried out by bubbling air at 95°C through groundnut oil, the distilled esters of its fatty acids, cocoanut oil and linseed oil show similar increases but at more rapid rate. The authors believe that this increase in nitrogen content is due to fixation of atmospheric nitrogen by the oils, which phenomenon does not appear to have been observed uptill now.

It has also been noted that in the case of aeration of oils organoleptic rancidity develops at a certain stage, which corresponds more closely with the nitrogen content than with the peroxide value. Nitrogen gas by itself also gets fixed by oils, though in the absence of oxygen this does not cause any rancidity.

The smell of rancidity caused by air containing both nitrogen and oxygen is different from the smell produced by the action of oxygen only.

150. A Note on Vegetable Oil and Alcohol Mixture used as a Fuel Oil.

S. S. JOSHI *and* S. HUSAIN ZAHEER, Hyderabad-Deccan

A mixture of groundnut oil and alcohol containing 10 to 12 per cent of alcohol was used in diesel oil engines. An addition of 0.5 to 1 percent of ether sulphuric removed the difficulty in the starting of the oil engine which was experienced with the above mixture, the mixture was satisfactory in all respects except that the engine required frequent cleaning to remove the deposits of carbon residue in exhaust lines. The mixture of winterised mowhra oil and alcohol in about the same proportions as above was found equally satisfactory

151. Properties of Fatty Esters.—Part I. Comparative Surface Activity and Wetting Power of Monoglycerides from Different Oils.

K. RAMA VARMA, Tatapuram.

Monoglycerides are surface active agents of the nonionic type. Due to their surface activity they are excellent emulsifying agents. They also possess significant wetting property.

A comparative study of the properties of monoglycerides prepared from three oils was made in respect of their surface tension and wetting power. The former was tested by a stalagmometer while the latter was done by the Drave's test and the canvas disc method. It was found that there is no direct relation between the surface tension of its solution and its wetting power.

It was also observed, from these tests, that monoglyceride perpared from cocoanut oil is superior to either Groundnut or Castor oil derivatives as regards their wetting properties.

152. A Method for Quick Extraction of Glue from Bones.

K. N. MURTHY *and* S. H. ZAHEER, Hyderabad-Deccan.

A method for quick extraction of glue from bones is described. The bone meal after removal of glue is as good a fertilizer as super phosphate of lime.

153. Evaluation of Decolourising Carbons.

K. S. G. DOSS *and* AJIT SINGH, Kanpur.

A method for evaluating decolourising carbons has been evolved, fulfilling all the necessary conditions for getting reliable results. It is found that when the necessary precautions are taken, the colorimeter can be used for absorption measurements involving caramel solutions.

154. Preparation of Active Carbon

N. V. JOSHI *and* R. D. VOKIL, Poona.

Preparation of active carbon was carried out with different oil seed husks such as Safflower, groundnut, Undi and also with Date seeds etc. The effect of various concentrations of $ZnCl_2$, $CaCl_2$ anhydrous $MgCl_2$ and NaOH on the materials from which activated carbon was to be prepared and also the effect of heating the carbon to different temperatures on its properties was studied.

The data presented on the different activated carbons prepared by various methods named above from which it appears that in the case of activated Carbon prepared from Safflower husk a descending order of activity was found with the treatment of the husk with $ZnCl_2$, anhydrous $MgCl_2$ and $CaCl_2$ in the test for examining the activity of the carbon for the adsorption of Methylene blue and Iodine.

155. Influence of Chemical Treatments on the Adsorptive Properties of Activated Charcoal: Adsorption Isotherms.

SUDHAMOY MUKHERJEE *and* SUKHAMOY BHATTACHARYA,
Calcutta.

The adsorption of methylene blue, iodine and acetic acid by a number of charcoals, prepared under different conditions, has been studied at various concentration of the adsorbates.

The adsorption, in general, is found to obey the Freundlich isotherm and straight line curves are obtained on plotting log a against log c. For the adsorption of methylene blue and iodine, zinc chloride-activated charcoal is more active than that activated with calcium chloride, sulphuric acid or caustic soda. The activity of the former, in respect of methylene blue, iodine and acetic acid, is increased by further treatment with solutions of oxidising substances, namely, potassium permanganate, dichromate and persulphate, bromine and perchloric acid. The adsorption of iodine by non-treated charcoals tends to fall at higher concentrations and this is more pronounced in the case of the non-activated charcoal.

The variations in the slopes and intercepts of the adsorption isotherms have been discussed.

156. Influence of Oxidising Agents on the Adsorptive Powers of Charcoal Part III. Bromine, Perchloric Acid and Potassium Persulphate.

SUDHAMOY MUKHERJEE *and* SUKHAMOY BHATTACHARYA, Calcutta.

The treatment of activated charcoal with aqueous solutions of bromine, perchloric and potassium persulphate, as a rule, results in an initial increase of the adsorptive powers with the concentration of the reagents and then a decrease at higher concentrations. The maxima usually occur at the concentration 0.05 N. No such maxima are noticeable after the treatment of non-activated charcoal with these oxidising agents, although the adsorptive power for methylene blue and iodine increases considorably.

The oxidising agents undergo reduction during such treatments in different degrees, in the order : $K_2S_2O_8 > Br_2 > HClO_4$. The oxidation of charcoal becomes manifest in the evolution of carbon dioxide and in the formation of rducing substances (after treatment with persulphate).

The suggestion has been made that the treatment with a suitable oxidising agent, as a final step in the manufacture of activated charcoal by the zinc chloride method, would result in a charcoal of better adsorbing power.

157. Preparation and study of Active Carbon.

S. KRISHNASWAMY *and* S. K. NANDI, Bangalore.

In view of the increasing importance of charcoal as an industrial adsorbent, an investigation of the preparation and study of active charcoal has been undertaken. The carbonisation of the bases for the preparation of active charcoal was carried out in an electrically heated alloy steel furnace 3″ in diamter and 24″ in length. Tamarind seeds were chosen as the base in view of their hardness and compactness of structure. About 1 lb. of the seeds were put in the furnace in each charge and the amount of gas and pyroligneous acid obtained was measured. The pyroligneous acid was subjected to A.S.T.M. distillation tests. Both chemical and physical activation by using respectively different concentrations of zinc chloride and superheated steam at different temperatures were tried. The quality of the active carbon obtained was tested for apparent density, iodine and methylene blue adsorption and decolourisation of oil. The carbon obtained under optimum conditions compared favourably with the standard carbons of the market. Further work is in progress with other waste materials and also on evaluation of the different carbons obtained as gas adsorbents.

158. Active Carbon from Exhausted Tribulus Terrestris.

K. K. Dole, *and* K. S. Moghe, Poona.

Tribulus Terristris (Gokharoo) is well known as a diuretic and tonic and is used in Ayurvedic medicines in the form of Asawa, Arishta and solid extract. The exhausted drug was dried and carbonized in presence of zinc chloride of different concentrations. The residue was noted to give a large volume of combustible gas during the process of carbonization and gives a great promise as a raw material for laboratory gas. Best active carbons were obtained from this material with 150% zinc chloride.

Adsorption of Methylene Blue Mg/gram was 727
” Iodine ” ” 877
” Acetic acid ” ” 131

These carbons are best suited for iodine adsorption, giving the largest value of the carbons tested so far, in our investigations. Capacity of acid adsorption is found to increase by using lower concentrations of zinc chloride and higher temperature of carbonisation.

159. Active Carbon from Exhausted Glycyrrhizæ Glabra.

K. K. Dole *and* K. S. Moghe, Poona.

Residue from the decoction of Glycyrrhizae Glabra with boiling water was dried and used for the preparation of the active carbon. Primary carbon was prepared by heating the residue in tubes heated in electric furnace and then steam-activated. Similarly the activation was also brought about by treatment with zinc chloride solutions of different strengths. Best carbons were obtained by treating the waste material with 40% zinc chloride.

Adsorption of Methylene Blue Mg/g. was 953,
” Iodine ” 619,
” Acetic acid ” 151.

Steam activation at 800° C. for 4 hours gave acetic acid adsorption of 270 mg per gram of the carbon.

160. Active Carbon from Exhausted Rheum Emodi.

K. K. Dole *and* K. S. Moghe, Poona.

Drug Rheum Emodi is both used in Ayurvedic medicine and Allopathic remedies. In Ayurvedic medicines it is used in the form of water extract and the British Pharmacopia prescribes the alcohol extract. The exhausted drug from both the sources is found to be useful for the manufacture of a very efficient active carbon. The exhausted drug was treated with different concentrations of zinc solutions, dried and carbonized at 400°C. Most efficient carbon was obtained by treating the material by 80% zinc chloride.

Adsorption of Methylene Blue Mg/gram was 1288,
” Iodine ” 723,
Adsorption Acetic acid ” 131.

With 100% zinc chloride one carbon gave the value of 1429 mg/gram with methylene blue and the material is being investigated thoroughly.

161. Active Carbon from Wood of Euphorbia Tirucalli.

K. K. Dole *and* K. S. Moghe, Poona.

Although Euphorbia Tirucalli is not used directly in any of the Ayruvedic medicines, its milk is used as an external remedy and for the preparation of some Bhasmas. However, it is well known that its wood gives a very soft variety of charcoal and was expected to give a good active carbon. This expectation was fullfiled and the best carbons were obtained by treating the powdered wood with 100 and 150% zinc chloride. The results are :

Adsorption of Methylene Blue Mg/gram was 983
” Iodine ” 825
” Acetic acid ” 111

It seems that the exhausted drugs yield good active carbons without any elaborate treatment because their cellulose structure is loosened and made porous during the course of their exhaustion either by boiling water or alcohol extraction. From the results so far obtained all the waste products studied in these investigations offer great promise for the manufacture of active carbons.

162. Alkaloidal Content of Hyderabad Nux Vomica.

S. HUSAIN ZAHEER *and* BALDEV SING, Hyderabad-Dn.

Strychnos Nux Vomica Seeds indigenous to Hyderabad State in abundant quantities have been analysed for its strychnine and total alkaloidal content for the first time. From the results of analyses, the total alkaloidal content is found to be 2.005% and strychnine content 1.06%. Strychnine content varies in different samples. The alkaloidal content though below B.P. standards is not so low as to make it commercially useless.

163. Utilization of Waste Products from Ayurvedic Pharmaceutical Industries.

K. K. DOLE *and* K. S. MOGHE, Poona.

In almost all districts of the Bombay Province there is at least one big manufacturing concern dealing with the Ayurvedic Pharmaceutical preparations. Plant products which are used for the manufacture of Âsawas and Arishtas consist of the following plants : Terminatia Arjuna, Seraca Indica, Tibulus Terristris, Boerhavia Diffusa, Terminalia chebula, Emblica Officialis, Rheum Emodi, etc. The drugs are either extracted with water or in recent methods extracted with alcohol and the residue is thrown away. However, the residues thus discarded accumulate in large quantities and their utilization is contemplated in this paper. Some of the waste products are useful as fertilisers and some fibrous materials can be used for the manufacture of paper-board. It has been found that one of the best uses of these residues would be manufacture of activated charcoal from them. Very good activated carbons have been prepared from Tribulus Terristris, Rheum Emodi, Glycyrrhizae and Euphorbia Tirrucalli. During the preparation of active carbons some of these waste products gave out large quantities of combustible gases and phenolic tars which can be exploited for useful purpose. Waste of Tribulus terristris and Glycyrrhizae Glabra are found to yield especially large quantity of combustible gas. Work on estimating the calorific value of the gases and the fractionation of the tars is in progress.

164. A study of Tikshna-Loha (preparation of iron in Ayurved).

G. S. PENDSE, S. N. YERAVDEKAR *and* (Mrs.) G. G. KANE.

A good preparation of iron in medicine is still to be hoped for. Of the several types of iron preparations used in Ayurvedic medicine, one type—namely Tikshna-Loha was taken up for study. Several samples of this preparation which approached to the standards laid down in the Ayurvedic texts were taken up for the study as regards their chemical, physical and clinical properties. A comparison was also made of the chemical and physical properties of the standard and commercial samples. The clinical work on standard samples appears to show, that the preparations are fairly comparable in their therapeutic effect to Citrated Ferrous chloride B.D.H. and with an additional advantage of smaller dosage and absence of secondary ill-effects of iron therapy. The study is also hoped to be of immense use for standardisation of Tikshna-Loha.

165. Scientific valuation of Fire Woods- PartI.

C. C. SHAH, B. N. MANKAD, R. D. PATEL *and* H. V. AMIN,
Anand.

An attempt has been made to study the calorific values of common and uncommon woods, with a view to evolve out a scientific procedure for fixing the prices of woods. From the result it is observed that

(1) The order of quality of wood based on traditional beliefs does not hold any good.

(2) The woods, even from uncommon trees which are not harnessed as fire-woods, possess very high calorific values.

(3) Eventually, the prices charged at present are arbitrary without any relation with the calorific values.

It is suggested that :—

(1) The valuation must be directly proportional to the calorific values read out from the graph for calorific value against moisture content.

(2) The use of uncommon wood materials with high calorific values should be encouraged in order to supplement the fire woods, which are popular and suffer from high pressure of demand.

166. Estimation of Beryllium in Indin Beryls by the Fluorometric method.

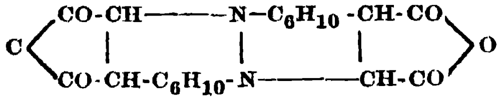
Miss. MONISHA BOSE, Calcutta.

Indian beryls have been examined for their Beryllium content by the fluorometric method developed by Mary H. Fletcher, White and Shefted (Ind.. Eng. Chem. Anal Ed. Vol.18, No. 3, 179-1946) using quinizarin in an alkaline citrate solution. The beryllium oxide content of the Indian ores from Ajmer have been found to vary from 12 to 13.5%. The results of the fluorometric method were checked by the chemical method and it was found tha the fluorometric method was accurate within 1%. The fluorometric method is of great advantage in routine analysis in as much as, it combines rapidity and simplicity with a fair degree of accuracy.

167. Reaction of Cyclohexanonazine with Maleic Anhydride.

D. B. DUTT *and* P. C. GUHA, Bangalore.

Aromatic aldazines react with maleic anhydride to give Crisscross adducts (Wagner-Jauregg, Ber., 1930, *63*, 322). Crisscross addition of cyanic and thiocyanic acids was extended to hydro-aromatic ketazines by Dutt and Guha (Curr. Sci., 1949, *8*, 297). Reaction of cyclohexanonazine with maleic anhydride has now been studied and it has been found that three types of products are formed depending upon experimental conditions : (a) In anhydrous benzene one molecule of azine reacts with two molecules of maleic anhydride to give the Crisscross adduct, 4,8-dicyclohexylidene-1, 5-diazobicyclo-(0, 1, 5)-octane-2,3, 6, 7- tetracarbonic anhydride (I); (b) in moist ether, equi-molecular amounts of azine and maleic anhydride react to give cyclohexylidene maleinhydrazine (II), and (c) in anhydrous benzene equi-molecular quantities give a resinous product.



(I)

C_6H_{10}=NH-CO-CH : CH-CO_2H

(II)

168. Studies in Sulfa-biguanides : Some N^4-substituted Biguanidyl-N^1-Benzoyl-sulfanilamides.

P. R. GUPTA *and* P. C. GUHA, Bangalore.

N^1-Benzoyl-sulfanilamide has been found to possess a very high antibacterial activity against certain strepto-and staphylo-infections *in vitro* by various workers (Sen Gupta, et. al. Ann. Biochem. Exptl.Med, 1946, *6*, 45; Bose and Ghose, Ind. Med. Gaz., 1949, *32*, 61). With a view to studying the effect of addition of biguanide grouping on this highly active sulfa drug it was substituted at N^4-position with aryl biguanide chains, and some N^4-biguanidyl-N^1-benzoyl sulfanilamides of type (I) have now been synthesised.

RNHC(=NH)-NH. C(=NH)-NH-C_6H_4. $SO_2NHCOC_6H_5$ Type I
where R=H, substituted aryl groups etc.

They have been prepared by refluxing N^1-benzoyl-sulfanilamide hydrochloride with the appropriate cyanoguanidines in pyridine medium and characterised as hydrochlorides. The following eight N^4-substituted N^1-benzoyl-sulfanilamides have been prepared :

1. N^4-biguanidyl-, m.p.240-241°(d)
2. N^4-(phenyl-biguanidyl)-, m.p. 264°-(d)
3. N^4-(*p*-chloro-phenyl-biguanidyl)-, m.p. 215-16° (d)
4. N^4-(*m*-chloropheny-biguanidyl), m.p. 239°
5. N^4-(*p* bromo-phenyl-biguanidyl)-, m.p.266-68° (d)
6. N^4-(*p*-iodo--phenyl-biguanidyl)-, m.p. 230-2°(d)
7. N^4-(*p*-anisyl-biguanidyl)-,m.p. 213-14° (d)
8. N^4-(*p*-tolyl-biguanidyl)-, m.p. 225-6°(d)

169. Essential oil from the Wood of Lansium Anamalayanum Dedd. Isolation of new Sesquiterpenes.

K. B. DUTT, SUKH DEV *and* P. C. GUHA, Bangalore.

The essential oil from the heartwood of Lansium Analmalayanum Bedd (Chigadmari oil) consists almost entirely of hydrocarbon constituents. By repeated careful fractionations through a partial condensation take off column, three distinct fractions have been isolated. These may be individual sesquiterpenes of unknown structure, and have been provisionally designated as Chigadmarene, Iso-chigadmarene and Neo-chigadmarene. All the three sesquiterpenes belong to the S-guaizulene type.

Chigadmarene, b.p. 140-142°/34 mm.; d^{28}, 0.8993; n^{28}, 1.4960 $(R_L)_D$, 66.2 $(R_L)_D$ for $C_{15}H_{24}F_2$, 66.14; $(a)_D = -203$ (1% $CHCl_3$ soln.); $(a)_D = -120$ (without dilution).

Iso-chigadmarene, b.p. 149-151°/34 mm.; d^{28}, 0.8941; n^{28}, 1.4950; $(R_L)_D = 66.56$; $(a)_D = -111.4$ (1% $CHCl_3$ soln.); $(a)_D = -66.8$ (without dilution).

Neo-chigadmarene, b.p. 154—157°/34 mm.; d^{28}, 0·8859; n^{28}, 1.4940; $(R_L)_D = 66.9$; $(a)_D = -63.3$ (1% $CHCl_3$ soln.); $(a)_D = -39.5$ (without dilution).

No crystalline derivative from any of these has been obtained.

170. Chigadmarene.

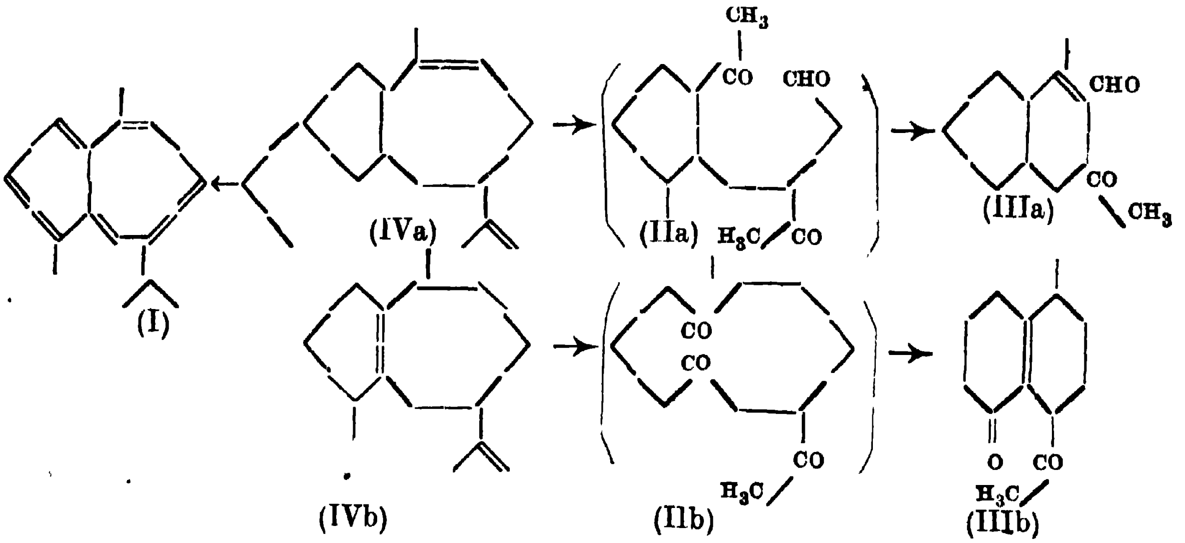
K. B. DUTT, SUKH DEV *and* P. C. GUHA, Bangalore.

The molecular refraction of the sesquiterpene indicates that it is a bicyclic hydrocarbon with two double bonds. A titration with perbenzoic acid has confiremd the presence of the two ethylenic linkage.

The sesquiterpene cannot be reduced by sodium and alcohol and does not form an adduct with maleic anhydride. However it gives a positive colour reaction with diazotised *p*-nitro aniline, which sometimes ndicates the presence of conjugation. But taking into account the other properties of the compound a pair of conjugated double bonds is not diagonosed.

The terpene on dehydrogenation with sulphur gives S-guaiazulene (I) which has been identified by the preparation of a picrate, m.p. 122. styphnate, m.p. 105-6°; T.N.T. compound 89.0° and T.N.B. compound, m.p. 151-2°. This reveals the carbon frame-work of the molecule.

In order to locate the two double bonds in the hydrocarbon, ozonolysis of the sesquiterpene has been studied. Formaldehyde is produced, which indicates the presence of at least one semicyclic ethylenic linkage. The other double bond appears to be endocyclic and is probably located in the seven membered ring, as a compound $C_{14}H_{23}O_3$ (III a or b) has been isolated amongst the non-volatile neutral products of ozonolysis. This product contains a double bond, reduces ammoniacal silver nitrate and gives a positive iodoform reaction. This is probably a secondary product of degradation, the primary product (II a or b) undergoing ring-closure. Such cases are not new in the terpene field. Taking into account all these points and other theoretical considerations only two structures (IVa, IVb) for the sesquiterpene are possible. Further work is in progress to definitely fix the structure.



171. Azulenes.

K. B. Dutt, Sukh Dev *and* P. C. Guha, Bangalore,

New reagents for the isolation, characterisation and purification of azulenes have been developed. Of these picramide appears to be the most suitable. It very readily gives a complex with S-guaiazulene, which crystallises in stars of black needles from alcohol-acetic acid, m.p. 163.5°. Even from crude S-guaiazulene, a practically pure product is obtained which needs no further crystallisation. The azulene can be regenerated from the complex by a simple treatment with cyclohexane or light petrol.

Similarly picryl chloride gives black needles, m.p. 97-98°, of the S-guaiazulene addition compound.

172. Essential Oil from Atalantia Monophylla.

U. G. Nayak *and* P. C. Guha, Bangalore.

Studies on the essential oil ffrom the leaves of *Atalantia monophylla* have been completed. The oil has been shown to consist chiefly of *l*-sabinene (38%), *l*-linalool (14%); *l*-linalyl acetate (19%) and unidentified higher terpenes (29%).

173. Essential Oil vrom Hymena Therum Tenhifolium.

U. G. Nayak *and* P. C. Guha, Bangalore,

An essontial oil from *Hymena Therum tenhifolium* has been isolated in a yield of 0.12% calculated on the fresh whole plant. The oil has the following analytical constants: d_{24}^{24}, 0.8130, $n^{24.5}$, 1.4712; $(\alpha)_D^{25}$, −5.16, sap. value 20.97; sap. value after acetylation 83.9. The main constituent of the oil appears to be a new acyclic monoterpene, b.p. 94.5-95.5°/86 mm.; d_{25}^{25}, 0.8014; n^{25}, 1.4693; $(\alpha)_D^{25}$, −6.04°. The terpene gives an adduct with maleic anhydride, m.p. 113-114°, and can be reduced with sodium and alcohol giving a dihydro-compound, b.p. 96.5-97.5°/70 mm.; d_{25}^{25}, 0.7849; n^{25}, 1.4500; $(\alpha)_{D\,25}^{\;\,25}$ −6.1; bromo derivative, m.p. 63-64°, Further work on the elucidation of its structure is in progress.

174. Essential oil from Hyptis suaveolens.

U. G. Nayak *and* P. C. Guha, Bangalore.

A greenish yellow oil (d_{24}^{24} 0.8826; n^{25}, 1.4848; (a) $_D^{25}$, 4.1°; sap. value 6.23; sap. value after acetylation 49.35) has been distilled from the leaves of *Hyptis suaveolens*. The hydrocarbons have been identified as 1-sabinene (31%), d-limonene (12.0%) and a sesquiterpene of the azulene group (12.0%).

175. Studies with Methone : Hydro-Acridones.

T. S. **Sivaswamy** *and* B. H. Iyer, Bangalore.

The N-methone substituted anthranilic acids reported last year were cyclised to the corresponding hydro-acridones.

The Clemmensen reduction of both the cyclised and the uncyclised products of anthranilic acid—methone condensation have been performed. In both the cases the products are the normal hydrogenated products, the CO-groups being converted to CH_2 groups. The compounds obtained melted at 240° and 100° respectively.

In the cases of condensed products, phenyl hydrazones, 2:4-dinitro-phenyl hydrazones have been prepared and identified.

Methone on dehydrogenation with sulphur has yielded two products melting at 125° and 204°. Characterization of these products is in progress.

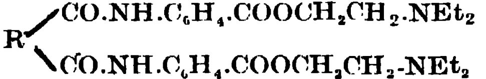
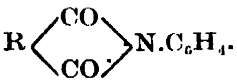
176. Local Anaesthetics.

P. V. G. **Krishnamacharyulu**, B. H. **Iyer** *and* P. C. **Guha**,
Bangalore.

Several (10) urea, thiourea and guanidine compounds of novocaine have been prepared with a view to studying the effect of groups like (1) NH_2CONH.—, (2) NH_2CSNH-, (3) $-NH.C(=NH)-NH_2$ and thier substituted derivatives replacing the NH_2 group of novocaine. Work on the preparation of biguanido, guanido-urea, and guanido-thiourea compounds of novocaine is in progress

177. Local Anaesthetics.

U. N. **Narayana Rao**, B. H. **Iyer** *and* P. C. **Guha**, Bangalore

With a view to studying the effect of acyl groupings added to the amino group of novocaine as local anaesthetic, compounds of the following acid-chlorides have been prepared; (1) Phosgene, (2) Oxalyl, (3) Malonyl, (4) Succinyl, (5) glutaryl, (6) adipyl, (7) Phthalyl. Compounds of the general formula  $R\begin{cases} CO.NH.C_6H_4.COOCH_2CH_2.NEt_2 \\ CO.NH.C_6H_4.COOCH_2CH_2\text{-}NEt_2 \end{cases}$ where R stands for such groups as $-CH_2-$, CH_2-CH_2-, etc.). have been obtained with 1-7. With 4 and 7, small quantities of compounds of the general formula  $R\begin{cases} CO \\ CO \end{cases}N.C_6H_4.$ $COOCH_2.CH_2.NEt_2$ (where R stands for $-CH_2-$ CH_2-, $-C_6H_4-$) have been obtained. Work on the preparation of corresponding acyl compounds from pyridine and quinoline carboxylic acids is in progress.

178. Condensation of Acetone with ethyl Nitroacetate.

D. B. **Dutt**, Bangalore.

In ethylnitroacetate, methylene group should be very active owing to the influence of the highly negative nitro and carbethoxy substituents, and hence should undergo condensation with carbonyl groups with the same ease as malonic, acetoacetic or cyanacetic esters. Moreover, the condensation products, owing to the presence of nitro group in alpha position to the carbethoxy, appear to be of promise as synthetic reagents to α-amino acids. With a view to studying the use of ethyl nitro-acetate as a reagent for amino acid synthesis, condensation with acetone has been tried, with methyl alcohol as solvent and sodium methoxide as condensing agent. Ethyl β-methyl-α-nitro vinyl acetate (b.p. 115-116/23-24 mm.) is obtained.

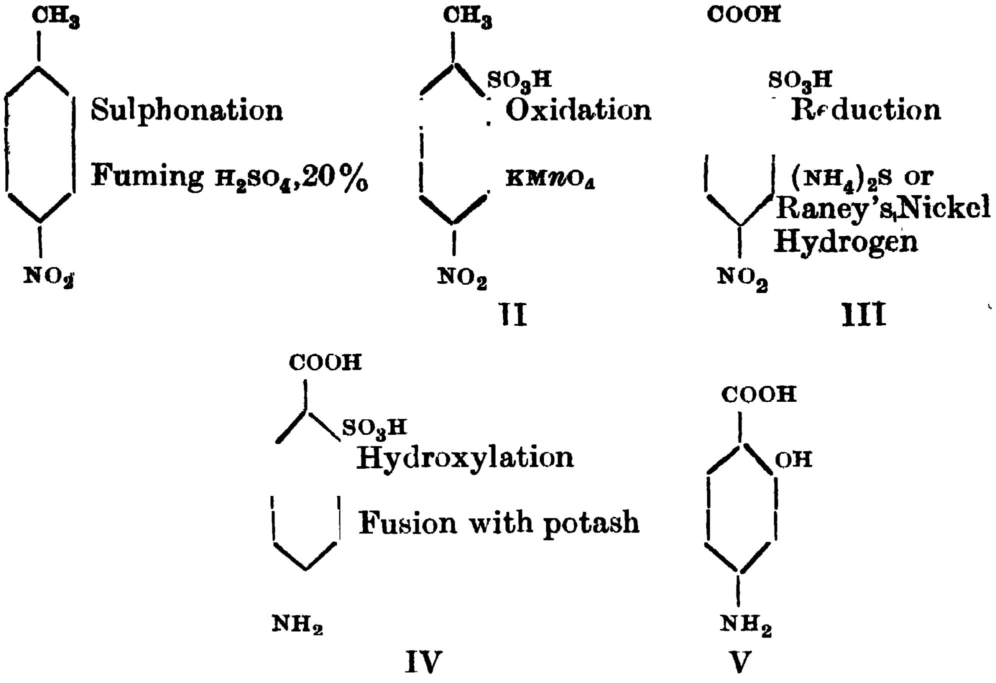
179. A new Synthesis of p-Amino Salicylic Acid.

M. **Raghavan**, B. H. **Iyer** *and* P. C. **Guha**, Bangalore.

p-Aminosalicylic acid which is now available commercially as its sodium salt under the trade name "PARAMISAN," has gained considerable importance in the chemotherapy of tuberculosis (Lehmann, Lancet, 250, 15, 1946; Youmans, Quart. Bull. North. Western. Univ. Med. School, 20, 420, 1946, cf. C.A. 41, 1011, 1947).

Clinical trials with the acid have amply shown that the acid which is well tolerated by man is remarkably effective in the treatment of pulmonary tuberculosis (D.D. Martin et al., Nature, 161, 435, 1948).

p-Aminosalicylic acid is prepared by a number of methods (Siedel & Biltner, Monatsh, 23, 423 1902; Ullmann and Wagner, Ann., 355. 360 1907; John T. Sheehan, J. Am. Chem. Soc. 70, 1665 1948; Erlenmeyer et al. Helv. Chimica Acta. 31, 988, 1948). Our method of synthesis of p-amino salicylic acid is as follows.



p-Nitrotoluene (I) was sulphonated to give 2-methyl-5-nitro benzene sulphonic acid (II), the potassium salt of which was oxidised with dilute potassium permanganate solution to the corresponding potassium salt of 4-nitro-2-sulphobenzoic acid (III). This on reduction with ammonium sulphide or with Raney's nickel and hydrogen gave 4-amino-2-sulphobenzoic acid (IV) which on fusion with potash yielded para-aminosalicylic acid (V) m.p. 145-146°. Yield 50%.

180. Preparation of Sulphuryl Chloride.

V. Lakshminarayana *and* B. H. Iyer, Bangalore.

A systematic study of the conditions for the preparation of sulphuryl chloride from sulphur dioxide and chlorine in the presence of camphor. activated charcoal prepared from coconut shell, paddy husk, wood and 'norite' as catalysts has been made.

A continuous laboratory method for preparing pure sulphuryl chloride has been described.

181. Investigations on the Ingredients of Wood Tar.

P. C. Guha *and* A. V. Kamath, Bangalore.

Bhadravati wood tar (84 lbs.) has been subjected to distillation and fractions coming at different temperatures separately collected, and their solubility in different organic solvents studied.

The fraction collected between 230-70° (about 45%) has been separated into the neutral, acidic and basic ingredients, the quantity of the last one being very small. The acidic portion has been subjected to fractional distillation and distillates collected at 10° range and then again at 5° range. By way of preliminary study, the presence of phenol, cresols, guaiacols, Pyrogallol dimethyl ether, xylenol, propyl guaiacol, has been established and confirmed by making known derivatives.

Experiments are in progress to isolate the ingredients in quantitative manner as far as possible, and to isolate compounds hitherto not described to be present in wood tar, by repeated fractionations and crystallisations.

182. Studies in Resins: Destructive Distillation of Rosin From Pinus Excelsa. Part I: Characterisation of the constituents from the neutral fraction of rosin spirit.

I. S. PATEL, B. H. IYER *and* P. C. Guha, Bangalore.

Although the chemical constituents of rosin oils from various American and French pine trees (mainly *Pinus palustris* and *Pinus maritima*) have been studied (cf. Kelbe, Ann. de Liebig, 1881, 210, 1; Renard, Ann. de Chimie et. Physique, 1884, p.223), the chemical constituents of rosin oil of Indian pine trees do not appear to have been studied so far. With a view to study the chemical constituents from *Pinus excelsa*, about 14 kg. of rosin was distilled and from the neutral fraction obtained after removing both acidic as well as phenolic components, the following compounds have been isolated and identified: methyl alcohol, 2-haxene, isobutyric aldehyde, methyl cyclohexane, toluene, p-xylene, cumene, pinene and *p*-cymene. Further work on the identification of the constituents from the higher boiling fraction is in progress.

183. Studies in Resins: Destructive Distillation of Rosin from Pinus Excelsa. Part II: Characterisation of the acidic constituents of Rosin Oil.

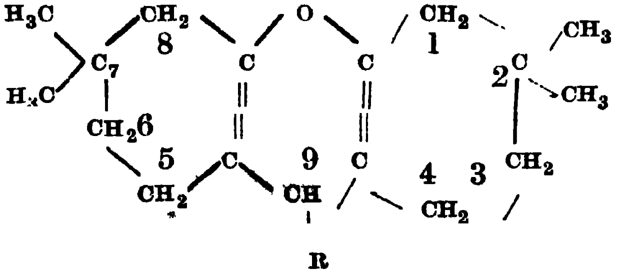
I. S. PATEL, B. H. IYER *and* P. C. GUHA, Bangalore.

After repeated fractionation of the rosin oil, acidic portions were separated by shaking with 5% sodium hydroxide solution and subsequent neutralisation with dilute hydrochloric acid. From the various acidic fractions after careful fractionation using a fractionating column of the partial condensation take off vigreux type, acetic, propionic, isobutyric and isovaleric acids were isolated and characterised. From the higher boiling fraction comparatively larger amount of abietic acid was obtained.

184. Clemmensen Reduction of Aldimethones.

M. V. KOWJALGI *and* B. H. IYER, Bangalore.

Dey and Linstead (J. Chem. Soc., 1935, 1063-5) obtained (1) 1, 1, 3-trimethyl cyclopentane (2) 2, 4, 4-Trimethyl cyclopentanone by the Clemmensen reduction of methone, During this reduction the cyclohexane ring contracted to cyclopentane ring. With a view to studying the behaviour of some derivatives of methone during Clemmensen reduction a few of the aldemethones have been thus reduced and the products characterised as 2, 2, 7, 7,—tetra-methyl-1, 2, 3, 4, 5, 6, 7, 8, octahydro-9-alkyl (or aryl) xanthen, indicating that no reduction in the size of the ring takes place.



Condensation of methone with glucose could not be effected under the conditions tried.

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SECTION OF ENGINEERING AND METALLURGY

PRESIDENT: D. R. MALHOTRA, D.Sc., A.M.I.E., F.I.M., M.I.E., F.N.I.

1. Studies in Anti-fouling Paints: Part 1.

S. M. DAS GUPTA, Delhi.

Ship's bottom is covered by minute animal and vegetable organisms found in abundance in sea water, as soon as the ship is water-borne, unless its bottom and wooden hulls are painted with anti-fouling paints. The weight of fouling organisms removed from the bottom of the boats has been found to be to the extent of 100-200 tons in certain cases, and this dead weight causes an increase in fuel consumption to maintain a certain given speed by as much as 30%.

Anti-fouling paint contains toxic agents, copper flakes, copper oxide, mercury oxide, of very low water solubility, in a paint vehicle, the water premeability rate of which varies between 70-150 (Wray and Vanvorst method). Mica is very useful paint pigment, and dehydrated castor oil offers certain specific advantages not possessed by linseed oil.

The typical formulation of an anti-fouling paint is:—

Copper flakes 26.6%, Mica Powder 11.46%, Coumarone Resin 15.2%, modified castor oil (castung) 7.21%, mineral spirits 33.3%, driers (naphthenates) 0.16%, Pigment by volume 24.5 and weight per gallon 10 90.

2. Improvement in the Construction of Floors, Roofs, Walls and other structures and structural components made partly of concrete. Paper 1.

P. B. GHOSH, Sibpur.

The paper deals with economising the concrete in the building of the floors, roofs and walls, and other ctructures and structural components made of reinforced concrete by using burnt clay blocks of T and channel shapes.

3. Building Construction with T. Bricks. Paper II.

P. B. GHOSH, Sibpur.

The Author has worked out the construction costs both with rectangular bricks and T-& L-bricks with or without channels and shows that the constructions with T-& L-bricks are much more economical than with rectangular bricks upto the extent of 25-50% depending on the class of building.

4. Effect of Reflux Ratio and other Operating Variables on Packed Column Distillation.

R. L. DASVERMA & S. K. NANDI, Bangalore.

The Authors have worked with ethanol-water system. Expressing column efficiency in terms of H.E.T.P., they found that H.E.T.P. increases:—

(1) With increase in distillation rate.

(2) With increase in feed concentration, and

(3) With decrease in reflux ratio.

R = L|D, where L is quantity of reflux flowing and D, the quantity of the product put back inside the still.

Further work is in progress with different concentration and different binary mixtures.

5. Upper Wind Observations with the Baby Maggie Radar and a Method of Adapting it to obtain upper winds by tracking the Radio-Meteorograh signaller.

B. K. GUPTA AND B. B. HUDDER, Poona.

Two types of targets, (1) Corner reflectors and (2) dipole, were tried. It was only possible to obtain a range of 16000 yds., but the long absence of the pip from cathod ray tube screen made an accurate minute to minute centering of the spot in the angle units impossible, and hence the idea of getting more range with fluctuating pip was given up.

Next the idea of using active targets like an oscillator generating 204 Mc|s (the frequency of the Radar) and following it with the reception side of the radar was taken up, and same signaller both for F. type radiosonde and also for radar wind finding was used.

The authors in their paper describe the construction of the oscillator, amplifiers of the signals and reception.

6. Study of Induced Voltage on a communication circuit under earth-fault conditions of a parallel H. T. Power Line.

H. N. SHRIVASTAVA, Delhi.

This paper gives details of an experimental investigation of the induced voltage on a telegraph wire carried on a line paralleling a 33 K. V. power line for 27.14 miles. An earth fault was produced at one end of the power line and oscillographic study of the voltage induced on the telegraph line made at the other end. The power line carries an earth wire of 0.042 sq. inches cross-section. There is an unbonded railway line running parallel to the telegraph posts about 24 ft. away on the opposite side. The screening effect due to this railway line is considered negligible. The induced voltage on the telegraph wire as obtained by this experiment is 25 per cent less than the theoretically calculated value. It may, therefore, be concluded that the screening effect due to copper earth conductor of 0.042 sq. inches cross-section on the power line is 25 per cent.

7. Niobium or Columbium.

N. R. SRINIVASAN, Bangalore.

The element of atomic number 41 is being referred in literature by the name Niobrium or Columbrium. Hatchett analysed columbite in 1801 and columbium was the name given to the new element, but Rose (1844) showed that what Hatchett considered an element was actually mixture of two elements, which he found tantalum (Eckberge 1802), and a new element which he named Niobium. Now the author contests that the nomenclature columbium be dropped and Niobium be adopted.

8. Flotation of Iron Pyrites from Mysore.

K. K. MAJUMDAR, Dhanbad.

Extensive deposits of iron pyrites, sulphur content varying from 30-42.4%, have been discovered at Ingaldhal, near Chitaldrug in Mysore State. The author has experimented into the possibilities of beneficiating this ore by flotation.

Average run of mine ore having 36.98% S. was ground wet to 200 mesh and floated in a 1000 gms, Denver Sub-A Flotation Cell. Best results were obtained with K-ethyl Xanthate (0.1 Lb. per ton), eucalyptus oil (0.1 Lb. per ton), Copper Sulphate (0.05 Lb. per ton) at PM 5 to 6, and the recovery was 75%.

9. Economic Voltage for Transmission of Power.

C. S. GHOSH, Bangalore.

Use of higher voltages for transmission of large blocks of power over long distances has been the universal practice. It has, however, been found that the economic voltage of transmission does not vary very much, though the distance of transmission may be anywhere from 100 miles to more than 600 miles. Crary and Johnson in their paper on "The Economics of long distant A C. Power Transmission" have shown that for loadings of the above 200 MW the economic transmission voltage varies from about 287 KV to 360 KV. depending on the length of transmission.

The author gives an analysis of costs of transmitting various loads from 100 MW to 500 MW at voltage ranges from 100 KV to 400 KV and over distances ranging from 100 miles to 600 miles.

10. A Note on Binary Alloys.

K. C. MAZUMDAR, Jamshedpur.

The binary alloys of some metals like Cu, Ag and Au can be expressed by approximately definite chemical formula and are known as abnormal valency intermetallic compounds. The different phases of these alloy systems have definite electron-atom ratios which are generally expressed as 1.4, 3|2, 21|13, and 7|4 for a, B, r and e phases respectively. They can, however, be expressed more uniformly as 21|15, 21|14, 21|13 and 21|12. This regularity suggests the possibility of this being extended inside the a-phase also. The a-phase may, then, be composed of several minor phases of electron-atom ratios, 21|16, 21|17, 21|18, 21|19, 21|20, at the boundaries of which there will be discontinuities, however, small, of some physical properties of the alloys. The indications of such discontinuities found in the published data are discussed.

11. Corrosive Gases in Producer Gas.

MOHANLAL KHANNA, Delhi.

In India wood charcoal is generally employed for the production of producer gas, and it has advantage over other solid fuels such as authranite coal, soft coke, etc. in its low sulphur content and critical air blast value.

Anhydrous ammonia is not corrosive as it has been employed in Belgium for running vehicles.

Sodium Chloride when present in charcoal contributes to wear of engine. The estimation of water solubles and sodium chloride content in wood charcoal for use in gas producers for vehicles should be included in the standard testing procedure.

12. River Valley Projects & Food Production.

K. B. Ray, Calcutta.

In this paper various River Valley Projects planned by Central Waterpower, Irrigation and Navigation Commission (CWINC) are analysed. Shri A. N. Khosla, Chairman, CWINC, has stated that "barely 6% of the enormous water wealth is being put to beneficial use and the remaining 94% is permitted to run waste, frequently doing untold damage to life and property in its passage to sea". The author finds that the river valley projects are planned with the idea of utilising that 94% water for the canal irrigation and hydro-electric power production in the dam areas by constructing a number of dam in the course of rivers. On analysis of various projects he finds that this scheme will dry the rivers in their lower courses and monsoon floods will soon render the canals unserviceable, dams filled up, and therefore greater danger of flood devastation of the land and population will be created and food production is lost. He suggests that instead of adhering to the idea of utilising 100% water of the river water, it will do better if the Tennesse Valley project is strictly followed and accordingly he suggests:—

(1) After regulation at the dams the whole of the water be allowed to flow down the lower and tidal reaches.

(2) A uniform release of water will be possible at the dams throughout the year so that hydroelectric power is generated continuously to the full installed capacity of the power plant at the dams.

(3) This power is to be utilised for pumping water from tube wells for the irrigation of the land, and also for industrial purposes.

(4) Under such a scheme, the continuous flow of water assisted by River Training Works at certain intervals in the length of the river, will guide to a well-defined narrow and deep channel, and such a river can be utilised for navigation for its considerable length.

He further says that the river valley projects should be available to the public for study and they should not be treated as State secrets.

13. Cyclone-cum-scrubbing filters for Producer Gas.

S. K. Das Gupta & Mohanlal Khanna, Delhi.

Producer Gas as used in mobile producer gas plants is filtered through a series of filters using fibrous matter and textile fabrics, which remove solid particles, but tarry matter and corrosive gases are allowed to pass.

The authors give device, which is a combination of a cyclone and a scrubbing arrangement based on the counter current principle.

14. Steel Economy.

O. G. F. Paulssen &K. Ray.

The authors in this paper describe Shape Engineering and Light Structural Section in the light of Steel Economy.

15. The effect of Phosphorus in steel in time of rolling.

N. N. Rakshit, Tatanagar.

The author describes the effects of Phosphorus on the properties of steel.

16. Treated Wood as Structural Material.

S. KAMESAM, Bangalore.

The author describes the various uses of treated wood and possibilities of replacing steel by wood.

17. Aluminium in Steel.

K. C. MAZUMDAR, Jamshedpur.

Inspite of its favourable size factor the primary solid solution of Al in the iron is very small; this is due to its strong electro-chemical factor. When the steel exists in this form the excess of Al is driven to the grain boundary and inhibits the grain growth. The electro-chemical factor makes it form radily the compound, FeAl, which has a body centred cubic structure. The grain of FeAl has a pronounced solubility in the iron; this is why only a single-phase is observed up to 50% Al added to the iron.

18. Laboratory Expriments on the Cleaning of Rewa Coals.

PROF. V. G. IYER AND K. C. SRIVASTAVA.

In this paper, the problem of cleaning high ashed Rewa Coal on a Laboratory Scale has been dealt with. The methods of cleaning and washing are detailed and a suggestion made to instal coal cleaning plants for improving these methods.

19. Utilisation of Fuel Wastes.

G. RAMARAO, Hyderabad.

Large quantities of coal clinkers are thrown out as wastes from power stations. An attempt is made in this paper to utilise it as a substitute for concrete and sand in making cement concrete. The cement concrete so made is much lighter and cheaper than ordinary cement concrete. The crushing strength compares quite favourably with the latter.

20. Electro-deposition of Copper from Cyanide-Free Baths: Copper Oxalate-Monoethanolamine Solutions.

N. B. SHIVARAMAN AND T. L. RAMA CHAR, Bangalore.

This investigation is concerned with the possibility of producing satisfactory electro-deposits of copper on steel, from solutions free from cyanides. Although cyanide baths have established themselves commercially, a search for substitutes continues, in view of the poisonous nature and the instability of these baths. The plating solution used in this work is very simple and consists of copper oxalate and monoethanolamine, a complex being formed in aqueous solutions. Like the low concentration cyanide strike baths of copper, these solutions do not plate on steel by chemical displacement, in view of the very low concentration of free copper ions due to complex formation. Satisfactory deposits have been obtained and they are comparable to deposits obtained from cyanide baths. A study has been made of the effect of variation in (a) concentrations of copper oxalate and amine, and (b) current density. The cathode current efficiency is very nearly 100%. The addition or recholle salt has been found to improve the anode performance permitting higher current densities and lower bath voltage.

21. Calibration by Step-Filter and its use in the estimation of Mn, Si and V in High Speed Steels.

B. N. BHADURI, M.Sc., D.I.C., Ph.D. (Lond.), Asstt. Physicist, New Control & Research Laboratory—Tata Iron & Steel Co. Ltd. Jamshedpur.

A new technique in calibration in steps with weighted manganese and their separation at fixed ratio was used for obtaining concentration-calibration curves for certain minor elements in high speed steels. As blackening curves obtained with plate calibration are not strictly parallel and separation as used for calibration purposes is taken arbitrarily at certain values of the densities following the slope of the curves it was found that one of the methods of eliminating errors in analytical works was by adopting the technique given. This itself is described in the text and the results obtained was found to agree with the chemical values as closely as can be expected.

22. Some Aspects of the Manufacture of Wheel Set Assemblies.

D. R. DHANBHOORA, Supdt. of Research, Tata Iron & Steel Co. Ltd. & S. VISWANATHAN, Asst. Supdt. of Research.

In the manufacture of wheel set assemblies a force fit procedure is employed for mounting the wheels on to the finished axles. The specifications relating to the manufacture of wheel set assemblies have been examined from the point of view of how far they are effective in determining the holding-on ability of the assembly. The theoretical basis of force-fit design has been discussed together with the various factors that determine the mounting characteristics. On the basis of a large number of tests the following conclusions have been reached:

1. The extent of plastic deformation during mounting is negligible.
2. The more important factors that determine mounting and demounting pressures are—
   (*a*) Out of roundness
   (*b*) Fit allowance
   (*c*) Lubricant
3. The surface finish of the wheel bore and the relative smoothness of the two components are not of great significance.

23. A Method of Computation of field Harmonics in the air gap of an Electrical Machine caused by the permeance variation due to slot opening.

DR. MATI LALL JAIN, Calcutta.

In this paper the author gives a simple method to mathematically analyse the effect of slot opening on the permeance curve of the air gap in an electrical machine. The first step in the analysis consists in substituting a simple curve for the actual permeance curve obtained by F. W. Carter. The former curve, which is a close approximation to the latter, is then resolved into Fourier's Series. Then the effect of permeance variation due to slot openings on two types of sinusoidal M. M. F. waves-stationary and rotating—has been given. It is shown that in the first case the slot openings cause in the flux wave a series of space harmonic pairs which form beats with a beat period of the pole pitch, while in the case of rotating sinusodial wave the effect of slot opening is to produce in the flux wave a series of pairs of rotating waves, the members of each pair rotating in opposite directions.

The analysis can be easily extended to an M. M. F. of any complex wave shape.

Dr. Moti Lall Jain D.Sc. (Harvard), M.E.E. (Cornell), B.Sc. Hons. (E&M) Banaras, Assoc. Member of A.I.E.E., is a professor of Electrical Eng'g. at College of Engineering & Technology, Bengal. (Jadavpur).

SECTION OF MEDICAL & VETERINARY SCIENCES

PRESIDENT: DR. M. V. RADHA KRISHNA RAO, M.B.B.S., Ph.D., F.N.I.

1. Diagnosis of Early Vitamin Deficiency States.

M. B. DAVER, Hyderabad (Deccan).

1. When deficiency diseases are well established there is no difficulty in diagnosing them.

2. It is extremely difficult to diagnose early Vitamin deficiency states, as there is no specific methods for diagnosis and have to depend upon indefinite symptoms and signs found on physical examination.

3. Nutritional diseases and early deficiency states constitute a great medical problem from economic and disability point of view ; because it has been ascertained that not less than 75% human ailments may be attributed to early Vitamin deficiency state.

4. In early Vitamin deficiency states, laboratory tests are of little help. Nothing abnormal may be detected in urine, there may be no change in blood-picture. X-Ray examination of fractional test meal may reveal nothing.

5. Associated symptoms are often inter-woven and over-lapping and very often resemble the symptoms of neurasthenia.

6. It becomes very difficult to separate these two kinds of conditions.

7. It is an established fact "some neurasthenics benefit by a properly balanced and forced diet. Thus one wonders what is more important, psychological treatment or proper food for their cure.

2. Nutritional Macrocytic Anaemias.

M. V. RADHAKRISHNA RAO and V. N. JAI, Bombay.

With the advent of newer therapeutic agents like Folic acid and Vitamin B12 in the treatment of Macrocytic Anaemias, considerable information is now available for a proper understanding of the aetiological factors associated with these anaemias. The present paper is a review of the recent work on the subject and gives an account of the authors' experience in connection with the diagnosis and management of cases of Tropical Nutritional Anaemias, commonly observed in the Relief Camps in Bombay.

3. A Field Investigation into Lathyrism.

M. N. RUDRA and L. KANT, Darbhanga.

The result of a field investigation into Lathyrism has been described and discussed 133 lathyrism cases were investigated and interrogated about their diets. Suggestions have been given for an all round improvement in the diets of the village communities where lathyrism is endemic. The evolution of an alternative hardy crop to Khesari is an urgent necessity.

4. Madura Foot (Mycetoma).

L. M. GHOSH, D. PANJA & N. C. DEY, Calcutta.

Mycetoma or Madura foot is not common in Bengal. It is common in South India and Rajputana. The disease was known in ancient India as a separate clinical entity. The history is given in chronological order.

The organisms isolated from the two cases were identical. Both the fungi were studied and identified as actinomyces madurae.

5. Diet Survey in Indian Hospitals.

M. N. RUDRA, Darbhanga.

A preliminary report on a Diet Survey carried out in the months of January, February and March 1947 in the Medical Ward of the Darbhanga Medical College Hospital has been given. It has been found that the intake of calories, and other nutrients except vitamin B1 is inadequate in the milkless diets supplied to the patients. Diets containing milk were better.

6. Study of Mental Symptoms in India.

NAGENDRANATH DE, Calcutta.

Study of mental symptoms in India indicate that they vary widely from those found in the Western countries. A study has been made of these symptoms as found in about 2,200 persons, suffering from various psychiatric disorders, who were examined either as in-patients in a hospital, as out-patients in 4 clinics or as private patients in their homes. Some of them were psycho-analysed.

DELUSIONS

Delusion of persecution as found in the West has almost always reference to persecution of self but here the delusional persecution of the relatives of the patient are quite common and of the relatives the following is the order of frequency: Children, brothers, sisters, parents and lastly the husband, wife perhaps never.

Among the methods of persecution not often found in the West are sucking of blood and employment of goondas for physical torture. Transference of disease by some magical means is a common method; another rather uncommon method was what the patients described as "obstructing the flow of life". This may be effected by means of a "ban" (arrow) or by other means. These *bans* were endowed with super-natural power by means of mantras.

The communal and political tension prevalent in the country often gave a colouring to the persecution. The supposed persecutor was often a member of the opposite political or communal party.

In delusions of poisoning, the vehicle for the poison is often a 'pan' (a dressed bettle leaf). Here some poisonous drugs or some potent 'mantras' play their part.

In megalomanic delusions the delusion of chastity is commonly found because chastity is valued by Indian women more than any other possessions. Among material possessions horses and elephants, play an important part probably because of abundance of these things in nursery stories. To understand the megalomanic delusions about religion one must be conversant with the stories and myths of the Indian religions. I think it is possible only in India that a megalomanic religious delusion is expressed in a most humble way *e.g.*, "I am a sweeper, my duty is to clean, to clean the world, God has ordered me so".

Self-depreciating delusion of sin is quite common. The following are regarded as the worst sins by the Hindus: causing an abortion, causing the death of one's own mother, father, a brahmin, a cow or any person, touching a diety with unclean body or clothes and misappropriation of money.

Delusion of influence in this country has almost always a mist of mysticity round it. The influencer is often believed to be endowed with mantras or tantras having supernatural power. Delusion of influence of self and other persons is also often supernatural in its performances.

Somatic delusions are quite common and many of them are associated with delusion of poisoning. Some patients are found to have systematised somatic delusions alone and are diagnosed as somatic paranoia.

OBSESSIONS

Obsessive thoughts, ideas of action are often intimately connected with religious ideas. The idea of passing urine and faces on the heads and faces of dieties. Sexual obsessions towards goddesses are very common obsessions. Obsessions on scientific subjects like life, the universe, electricity, radio, atom bomb etc. are not less but are rather more common than in the west.

Obsessive imagery in which an image, often a sexual one, persists before the mind's eye without any associated thoughts or wishes, are quite common. They are not the remembered images if anything actually seen but are the products of imagination.

Obsessive feelings are found in those cases in which there is no accompanying thoughts or ideas on one hand nor can this feeling of tension and distress be relieved by any compulsive act.

Obsessive tendencies are intermediate in form between obsessions and compulsions. They differ from obsessions in that they are tendencies for action and from compulsions in that they are never carried into action. Some of them are sexual in nature. Stealing tendency is also a very common one.

COMPULSIONS

Over 90 per cent of the compulsions are either washing or performance of some rituals associated with the idea of uncleanliness. The acts are symbolic in most cases. Compulsive speech and writings are either unconscious wish fulfilments as in cases of utterance or writing of obscene words and sentences or expiatory in nature as in cases of reciting or writing the names of gods and goddesses for a definite number of times or saying a prayer for a definite length of time before which no rest can be obtained.

Compulsive repetition of actions for a number of times is quite common. Closely allied to this is the compulsion of having things in duplicate or triplicate or not at all. Compulsion to do and undo things in the same fashion is not rare. If such a patient enters a room by one door and comes out by another he has the compulsion to enter the room again by the 2nd door and come out by the first.

Just as there are cases of compulsive acts there are also cases of compulsive inactivity. The patient describes his symptoms by saying that he feels hurdled on him a big stone of inactivity which he is unable to remove.

DOUBTS AND INDECISIONS

Pathological doubts are of ordinary kind. Indecisions are always accompanied by anxiety. Many of the indecisions found here are dependent on local superstitions *e.g.*, which foot to put forward first when starting for a long journey.

HALLUCINATIONS

Auditory hallucinations are by far the commonest and they are voices in most instances. About half of them are friendly conversations with gods and goddesses and with living or dead persons, known and unknown, and the other half are usually commands, threats or abuses mostly in filthy language. Hallucinatory commands are usually very exacting and often against the conscious wish of the individual. Visual hallucinations are far less common and only in rare instances visual and auditory hallusinations are combined *e.g.*, a person is seen standing in front in a shadowy form, and talking.

Olfactory hallucinations are more common in this country than in the Western countries. This is connected with the belief that when gods and goddesses appear they fill the air with smell of sweet flowers and that some Sadhus can also do so.

PHOBIAS

The ten commonest phobias are mentioned below in the order of frequency in which they are found in this country:—Diseases, death, ghosts, loneliness, insanity, animals, thieves and dacoits, punishment, enclosures (including rooms) and fall (with or without death). Of the diseases tuberculosis is feared most though leprosy is hated most. In some cases of fear of death it is not the fear of one's own death but the death of near relatives that is apprehended.

PHANTASY

Almost all the phantasies are sexual either in the direct or in the indirect form. Many women and some men think themselves to be wives of God in phantasy. Unmarried women become married in phantasy and put on the dress and signs of married women. Married women sometimes phantasy themselves as unmarried.

7. Treatment of Dermal Donovan-leishmaniasis with X-Rays.

G. PANJA, Calcutta.

Successful treatment of oriental sore with X-rays was described by the author (Ind.Med.Gaz. 1946, *80*, 251). Since then, treatment of dermal Donovan-Leishmanias's with X-Rays was tried by the author and found highly satisfactory. The Leishmania parasits were found radio-sensitive. About a dozen cases were treated and eight cases have been recorded. Nodular infiltration and hypo-pigmented lesions on the skin as well as nodular lesions on the tongue were exposed to X-rays. Full erythema doses were given on the nodular lesions and fractional doses on the hypopigmented patches. Stibatin (Glaxo) concentrated, 2 to 3 c.c. intramuscularly, were also given daily for about a month. The lesions which were exposed to the X-rays recovered completely. The hypopigmented lesions which are very refactory to treatment with artimonials disappeared completely. The nodular lesions which were not exposed to the X-rays recovered only partially inspite of the treatment with stibatin. Some cases treated with X-rays alone responded very satisfactorily. Along with X-rays, antimony treatment was given to ensure quicker and permanent recovery. For nodular lesions 4 to 5 exposures were necessary and for hypopigmented lesions 4 to 5 were given. The author treated many cases with neostibosan, solu-salvasan and iodide mixture but no complete cure was obtained. Since introduction of the X-ray treatment he is so satisfied with the beneficial result that he would recommend in every case the combined treatment with X-rays and antimony. Neither any X-ray burn nor any disastrous results were obtained with this treatment.

8. Aetiology of Infantile Eczema.

G. PANJA, Calcutta.

The aetiology was studied under the following heads:—Age, sex, age and season of onset, number of the birth of the victim, general health, food, teething, gastro-intestinal disturbances, susceptibility to cold, external influences, such as clothing, soap, oil and exposure, mother's food, family allergy, sites of initial lesions, contagiousness, relapses, course of illness, milk—sensitiveness, eosinophilia, condition of stools, seborrhoea and effect of treatment.

The conclusions are that the disease appears to be an atopic dermatitis but the source and nature of the atopen are not yet definitely established. This much can be said that it is not possibly cow's milk. Although sensitiveness to milk is elicited in a large number of eczematous infants, the same is true with non-eczematous infants also. Environments such as clothing, soap, oil and residence and teething have little to do with the causation. No association is found with the mother's food in breast-fed babies. Gastro-intestinal disturbances are present in a very small percentage of cases. Ill-health is not a predisposing cause. Most babies are healthy and fat. Highest incidence is in the first month of life. Eosinophilia 10 to 15% is present in most cases. 30 to 40% of the infants are susceptible to cold. Family allergy is elicited in about 20% of cases. Lower legs, cheeks and scalp are most often affected. The disease is most common in winter *i.e.*, from December to February. It is possible that the lower legs, the face and the scalp become sensitised on account of variation in temperature and exposure to harsh and chilly weather. The affection is not contagious unless secondary infection with pyogenic organisms has supervened. That the external factor plays an important job in the causation is shown by ready response to X-ray treatment.

9. Erythema Pigmentosom—A New Disease Hitherto Undescribed.

G. PANJA, Calcutta.

Many cases have been seen and recorded. The disease is characterized by a sudden onset of circular or oval patches showing erythema, oedema and dark pigmentation. Sometimes vesication is seen. Repeated attacks take place and most eruptions are ***fixed*** eruptions. The disease appears to be due to a toxin from a septic focus. Aetiology, histology, clinical features, biochemistry etc of blood, investigation to septic foci and treatment are described.

10. Diagnosis and Treatment of Tuberculoid Leprosy.

G. PANJA, Calcutta.

Tuberculoid leprosy is otherwise called 'Lepra Reaction'. This is a fulminating tissue reaction characterised by Angry-looking oedema and infiltration which have a tendency to spread and is caused mainly by leprotoxin in a sensitive or partially immune individual. Associated symptoms such as pain, temperature, tingling, etc. may occur. Histologically, a large number of mononuclear cells and giant cells are found.

The reaction may occur either in neuromacular or lepromatous (cutaneous) type of leprosy. Thus a neuromacular type may look like a lepromatous or nodular type of leprosy if an extensive reaction occurs. Microscopic examination usually shows scanty or no leprosy bacilli. But in the reaction of lepromatous type, bacilli are always found. Sometimes the oedema and infiltration are so slight that it is difficult to diagnose the tuberculoid stage. Histologic examination is not easy and always possible. A simple test for diagnosing the reaction stage is to fix a lesion with two fingers, incise with a scalpel, squeeze out the blood-stained fluid and make films like blood films on a slide. Leishman's staining will show a very large number of mononuclear cells including lymphocytes and monocytes and a small number of polymorphonuclear cells. A non-tuberculoid lesion or normal skin will not show such an excess of mononuclear cells. The best way to count the cells is to count 200 mononuclear cells and at the same time count the polymorphonuclear cells and then make a note. Counting of the latter is then continued if necessary until the figure 100 is reached. Mononuclear cells should also at the same time be counted. Thus a double check to the counts is given. It is needless to mention that if mononuclear cells are in great preponderance 100 only should be counted and it is not necessary to proceed with further counting.

It is the tuberculoid stage that greatly upsets the mind of patients and treatment for ameliorating such a condition is of paramount importance. Antimony, calcium arsenic in small doses non-specific vaccine therapy, such as sterodin, polydin, milk, autobeems, redoxon, adrenalin etc. have their values. The author has tried glucose with antistine intravenously daily or glucose in bigger dosage followed by insulin and achieved rapid and remarkable success. Glucose is considered to be drug of choice in lepra reaction. Further work is in progress.

11. Treatment of Lupus Valgaris with Caustic and X-Rays.

G. Panja, Calcutta.

Lesions of lupus vulgaris of the face, chin, buttocks and thighs and of lupus verrucosa on the feet are cauterised with pure phenol followed immediately by strong nitric acid and are also exposed to half to full erythema doses of X-rays at intervals of 2 to 4 weeks. Cases are cured completely and no untoward effects of X-rays have been noted. Some cases have been treated with the above caustics alone and finally cured. Malt extract of codliver oil is given internally when general health is found poor. There is no necessity to administer super concentrated vitamin D in any case. The combination of phenol with nitric acid results in explosive evolution of a gas that penetrates deeply into the lupoid tissue and brings about cure.

12. Enteric Fever in Bombay—Laboratory Diagnosis.

D. W. Soman & B. G. Modi, Bombay.

The paper deals with the laboratory data in the diagnosis of enteric fever, collected during the last ten years, the chief methods used being blood and clot cultures, Widal tests, white blood cell counts and cultures of stool and urine. Different media were tried for the primary isolation of organisms from blood and clot cultures including the problem of contaminated clot-culture; and Hartley's broth and glycerine-peptone-ox-bile medium were found to be the choice for routine blood and clot-culture methods respectively. The comparative value of whole blood and clotted blood cultures was studied and it was realized that the latter gave more positive and earlier results than the former. The commonest organism isolated was B. typhosum during the last ten years, the next being B. paratyphosum A, the ratio being 9: 1. A few salmonella organisms (food-poisoning group), B. faecalis alkaligenes and B. Coli were also isolated, on rare occasions. Relationship between Widal and Cultural examination was studied in a group of cases and it was strikingly observed that approximately 40% of bacteriologically proved cases showed negative Widal reaction, although blood was collected after 10th day of fever. The diagnostic value of Vi agglutination in the un-inoculated cases, was found to be low as compared with that of the combined method of H & O agglutination.

The white blood cell count as well as the differential count, did not give significant help in the early diagnosis of an enteric case.

Selective media were tried for the isolation of causative organism from stools and urine and D.E.C. medium was found very useful for isolation of these intestinal pathogens.

13. Rickettsial Diseases in India.

D. W. Soman, Bombay.

The author briefly narrates how rickettsial diseases received such scant attention in India prior to world war II from the medical profession in general and research workers in particular. It is really the last war that has given great impetus to the study of this group of fevers and much data has now been accumulated in India to show that these fevers are quite common in the cities and perhaps much commoner in the country-side. The known rickettsial diseases have been divided into five major groups and those present in India are chiefly discussed in brief in reference to their clinical, epidemiological aspects. The place of laboratory in the diagnosis of this group of fevers is stressed, using proteus and the specific rickettsial reagents. The author has studied this aspect in reference to the Bombay city, where he found the murine or flea-typhus to be prevalent all the year round. The rodent reservoir was studied by obtaining sera for complement fixation tests, which showed that 25% of the rodent population on the whole and 50% on a particular species, Rattus norvegicus suffered from past infection. The occurrence of scrub or mite-typhus in a metropolitan city like Bombay aroused great interest since it was established by the author by isolation of strains from cases of typhus fever and also its peculiar seasonal incidence was demonstrated. As regards the position of tick typhus in India, much experimental work is necessary before it is finally established Latest drugs, such as para-amino-benzoic acid, chloromycetin and aureomycin are discussed in the treatment of typhus.

14. Studies on Experimental Diabetes.

Part IV—Role of Intermediary Fat Metabolites in causing ketoasis in animals and the comparative effect of insulin and amellin in relieving the symptoms.

M. C. Nath and (Miss) Kusum S. Laul, (Nagpur.)

1. Animals receiving daily injection of sodium aceto-acetate do not show initial increase of blood ketone bodies to an appreciable extent till 71 days after which a sudden increase is observed.

2. When amellin is injected simultaneously to the animals showing gradual accumulation of ketone bodies, utilization of those bodies sets in, thus showing the important role played by amellin, either in helping utilization of ketone bodies by the extra hepatic tissues or in checking their excessive formation in the liver.

3. Insulin also helps the process but the utilization is not so high as with amellin.

4. The value of the ketone bodies of the liver of animals treated with amellin for 40 days is far less than that of the control animals receiving sodium acetoacetate alone.

5. Effect of insulin is not so pronounced as that of amellin.

15. Role of Cobalt in Experimentally Induced Anaemia in Rabbits.

Bani K. Bhattacharya and S. B. Broacha, Bombay.

It was known for a long time that Cobalt possesses blood regenerating properties. Recently it has been found out that the new anti-anaemia drug Vitamin B12 contains traces of Cobalt. We have used Cobalt Glycinate because it can be easily administered parenterally and is absorbed slowly in the system, while other salts of Cobalt like chloride and nitrate require large doses.

Six healthy rabbits were bled twice a week for two weeks. Before the treatment started their R.B.C. and hæmoglobin was brought down to 2.5 millions and 5 gm. respectively, and the reticulocytes from normal level of 2 to 25%.

Two rabbits were injected with 10 mgm|kg of Cobalt glycinate and O.1 cc|kg of liver extract, other two with only O.1 cc|kg of liver extract and the rest were kept as control. (Livei Extract used was "Cipalon" manufactured by Cipla Laboratories.)

Altogether seven injections were given intramuscularly on alternate days. In the liver extract cobalt group reticulocytes remained above 30% throughout the experiment. In the liver extract group reticulocytes came down to normal level on the tenth day after the treatment started, in spite of the injections being continued. In the control group the reticulocytes slowly came down to normal in about 8 to 10 days.

In all the three groups the increase of R.B.C. and hæmoglobin regeneration was uniform and followed the same pattern.

16. Metaplasia in Cervical Carcinoma of Uterus.

The present paper is a study of an unusual metaplastic transformation of a frank epidermoid carcinom of the cervix as it invaded and spread towards the funds uteri. Explanation for this metaplasia is attempted in this paper from peculiar histological features of the uterus as compared to the other tissues in the body. Other curious feature of the case was the preference shown by the primary growth to invade through the compact wall of the uterine body rather than produce a familiar cauliflower growth in the vaginal cavity.

17. Detoxification of Tyrothricin by Certain Fungi and Gram-Negative Bacteria.

P. N. NANDI, Calcutta.

Tyrothricin, an antibiotic obtained from *B. brevis*, a normal inhabitant of soil inhibits the growth of *Staph. aureus* at a concentration O.1 microgram per millilitre of nutrient broth thus giving an activity of 1; 10,000,000. It was observed that this antibiotic when applied to fresh soil, inhibits the growth of soil micro-organisms in general only temporarily even at a higher dose (2.Omgm|gm of the wet soil). On continued incubation of the treated soil the substance was not traceable and there was a marked predominance of fungi and certain types of bacteria of the dilution plates. They were isolated and grown in Tyrothricin-containing media in which the growth was almost normal after an initial lag phase.

The culture filtrates and mycelium extracts of some strains of fungi detoxified tyrothricin after a few hours of contact. Similar was the case with Gram-negative bacteria. It was, therefore, concluded that although there is a great possibility of Tyrothricin being produced in soil, the chance of its being toxic to other soil organisms living in association, is very little.

18. Studies on Plant Extracts, Part I. Antibiotics from Hiptage Madablota Gaertn.

A. N. BOSE and G. C. MITRA, Calcutta.

In continuation of our previous work on antibiotics from higher plants, further studies have been made to purify the extract from *Hiptage madablota* Gaertn. Roots, collected from various sources were extracted with hot alcohol, hot and cold water or a combination of any two, and later subjected to fractionation by lead acetate precipitation and decomposition by H2S. By such treatment, it has been possible to get metrials from the roots, which were active against a number of pathogens *e.g., Staph. aureus, B. Shiga, E. Typhosa; Sh. Sonnei, Vibrio Cholerae* (Inaba and Ogawa in dilution of 1 in 6000. Against B. Shiga, the Extracts were active up to 1|15000. It is however being noted that extracts prepared from the roots of different places and of different season give extracts with different types of antibacterial spectrum. Thus, while some extract show highest bacteriostatic activity against *Staph. aureus,* others show such against *B. Shiga.* It is suggested that probably more than one antibiotic principles are associated with the plant. It is further found that when purified toxic factor may be eliminated to a great extent.

19. Studies on the Chemotherapy of Bacterial Infections.

PART I.

A. N. Bose, Calcutta.

Sulphonamides are being extensively used in the treatment of bacterial infections, but studies on their chemotherapeutic value against *V. Cholerae* have so far been limited. Attempts have been made from this laboratory to study the synergestic effects of sulph drugs with Cholera bacterio phage (Sen and Basu, Ind. Med. Gaz. 1945). Since it is known that Sulphonamides in active anionic form plays an important part in effective bacteriostasis, various p-hydroxy methyl amino benzene sulphonamide derivatives, have been synthesised and are being studied for possible bacteriostatic and bacteriolytic properties. The compounds, reported in this paper are the respective formalin condensation products of sulphathiozole, Sulphacetamide, Sulphanilyl-benzamide, Sulphadiazine, Sulphamerazine and Sulphamethazine. Anti-bacterial tests have been carried against *V. Cholerae* (Inaba and Ogawa) in 1% Difco peptone water (pH 7.8), Glucose broth, papain digest broth, and by the agar strip method. It is being found that amongst the series tested,—Formo—Sulphacetamide (S.A.F.) and Formo-Sulphathiozole exert the best and equivalent bacteriostatic action, but the latter is much weaker in bacteriolytic properties. Formo-Sulpha benzamide (S.B.F.) exerts the same bacteriolytic action as S.A.F. though bacteriostatically it is slightly weaker. The other derivatives stand below S.A.F. in anti-bacterial potency. It is suggested that both S.A F. and S B F. merits further evaluation in the clinical fields.

20. Studies on the Chemotherapy of Bactorial Infections.

PART II.

A. N. Bose, Calcutta.

In this communication the respective formaldehyde condensation products of sulpathiozole (SFT), Sulphacetamide (S.A.F.), and Sulphabenzamide (S.B.F.) have been screened against a number of pathogenic organisms, viz., *Streptococcus haemolyticus* (Richards), *Streptococcus viridans,* Pnenmococcus Type I, *Staphylococcus Aureus, Escherichia Coli, shigella Dysenteriae* (Shiga), *Shigella Sonnei, Eberthelaa typhosa, S. paratyphi* A, *B. Pyocyanus,* and *B. Proteus Vulgaris* (Ox2 and Ox19). Comparisons have been made with sulphalthiozole(ST). Against St. *viridans,* S.A.F. and S.B.F. appear to be the most active bacteriostatic agents. S.T.F. and S.T. are inactive in this respect S.B.F. exerts the highest bacteriostatic action against the pathogens of the genetourinary tract such as B. *Pyocyanus, Proteus Vulgaris, E. Coli* and *Staphylococcus aureus.* S.A.F. also exerts similar action against all these organisms except having a slightly lower activity against *B. Pyocyanus* and *Staph. aureus.* Even at 200 mg per cent, concentration, S.T.F., is inactive against all these organisms, and sulphathiozole is equally so except for some activity against *E. Coli.* though much below that of S.A.F. or S.B.F. All the compounds exert powerful bacteriostasis against *B. Shiga,* (12.5 mg%) and moderately high effectiveness against E. typhosa. It is suggested that the formaldehyde derivatives, particularly S.A.F. and S.B.F. be given more extensive trials in the clinical field.

21. Studies on the Antibacterial Effect and Toxicity of Amellin.

M. C. Nath and (Miss) Kusum S. Laul (Nagpur).

1. A preliminary study on the antibacterial effect of amellin shows that it possesses bacteriostatic property.
2. Growth of S. aureus was inhibited considerably at a concentration higher than 1:500, there being complete inhibition at 1:125..
3. Even when administered orally to the mice in a very high dose of 1000 mg. per kg. body wt., amellin was found absolutely nontoxic.
4. Studies on subcutaneous acute toxicity indicated that amellin proved fatal only when the dose exceeded 750 mg. per kg. body wt.
5. The cumulative toxicity tests (subcutaneous) were also made and a daily dose of even 200 mg|kg. was found almost non-toxic when continued for 10 days, only one out of six dying on the 6th day.

22. Streptomyein in Tuberculosis.

Dr. C. N. Chandrachud, Poona.

Streptomycin a drug with antibiotic activity is used clinically in many forms of Tuberculosis. The paper deals with its use in Pulmonary Tuberculosis. Before the discovery of Streptomycin Collapse therapy was the chief method of treatment in selected cases of Pulmonary Tubersulosis and gave fairly satisfactory results with reduction of mortality rate. There is growing tendency to use streptomycin in each and every form of tuberculosis irrespective of its stage with the result that the conventional line of treatment is likely to be set back in addition to the two attendant risks of streptomycin therapy: (1) emergence of drug resistant strains of tubercle bacilli and (2) Toxic effects. For the study of the paper cases of Tuberculosis are divided in to seven groups and the effect of streptomycin noticed. Results in Meningeal and Miliary tuberculosis were disappointing. There was no distinct advantage in tuberculos empyema. Its use was attended with immediate symptomatic relief and this was particularly noticed in exudative type of pulmonary tuberculosis. In Pulmonary Tuberculosis with laryngeal and abdominal complications streptomycin gave good results. It was also found to be a useful adjuvant in some cases of pulmonary tuberculosis treated with collapse therapy. On an average 1 g. was given daily and the total quantity given was on an average 40 to 45 gms. It was used intrathecally and parenterally in meningitis. In empyema it was given intrapleurally and intramuscularly. Toxic effects were practically nil. X'ray plates of patients are produced and as far as possible patients will be demonstrated.

FROM THE DEPARTMENT OF TROPICAL MEDICAL, SCHOOL OF TROPICAL MEDICINE, CALCUTTA

23. Single-dose Treatment of Malaria.

R. N. Chaudhuri, M. N. Rai Chaudhuri & B. N. Dutta, Calcutta.

This investigation was undertaken with a view to devise a simple form of treatment for malaria to suit the mass of people in rural areas who are for various reasons unable to take a full thirapeutic course. The object was to find a single non-toxic dose from the newer antimalarial drugs, Paludrine, Chloroquine and Camoquin which will be able to effect a clinical cure, after which the patient can himself continue to take the drug once or twice a week during the malarial season or longer. Comparative therapeutic trials of these three drugs in single doses (0.5 gm. each) were carried out in a series of 75 patients admitted into the hospital. They included 36 *falciparum*, 35 *vivax*, 2 mixed (*falciparum and vivax*) and 2 *malariae* infections. *Results*:—Clinical cure was effected in all the cases. The asexual parasites disappeared from the peripheral blood within 3 days after the treatment was given, in 80% of cases treated with Paludrine and 100% cases with Chloroquine and Camoquine. The corresponding figures as regards fever were 84, 100 and 100 per cent respectively. Comparison between the latter two drugs shows that all Choloroquine cases and 80% Camoquine cases became parasite-free by the end of the 2nd day after treatment was started, the corresponding figures as regards temperature being 84% and 76%. Thus all three drugs seem effective to the extent of bringing about a clinical cure, Chloroquine being quick, Paludrine slow and Camoquine intermediate.

The patients were under observation for 1 to 2½ months. None of them had any treatment after the single dose they had received on admission. During this period, 9 patients in Paludrine series, 5 in Camoquin and 2 in Chloroquine series had recurrences of fever (parasitic or clinical). These results, therefore, indicate that the clearance of asexual parasites and fall of temperature can be effected though at varying rates, by a single dose of 0.5 gm. of any one of these drugs. This may particularly suit rural dispensing practice in endemic areas, among the semi-immune papulation. Relapses and incidentally reinfection may be suppressed by subsequent weekly or bi-weekly doses.

2. CHEMOPROPHYLAXIS OF MALARIA

The experimental work on the control of malaria in a hyperendemic rural area with weekly or biweekly doses of Paludrine, Choroquine and Camoquin was carried out during the malarial season. There was a definite progressive decline in the infection rate in all the groups except the control. The spleen rate was also considerably reduced. As regards fever it was the general impression that those,who took the drug regularly had very little malaria while many of the control group were badly suffering from it. No toxic symptom were encountered in any group.

3. PALUDRINE LEVAL IN BLOOD

The hydrolytic method of Spinks and Totey (1946) was employed to determine Paludrine level in blood following different single doses. The maximum concentration was attained usually 4 hours after the dose. It fell rapidly on the second day and generally disappeared on the fourth day. Individual variations were also observed.

4. PALUDRINE EXCERETION IN URINE

The excretion of Paludrine in urine was studied in a series of malaria patients receiving different therapeutic dosages, employing the method of Gage and Rose (1946). There was considerable individual variation and the time of urinary elimination of the drug was found to vary from 3 to 12 days.

24. Two New Drugs of the Treatment of Kala-azar.

P. C. Sen Gupta, Calcutta.

A series of 26 cases of kala-azar, half of which were stibio-resistant cases, was treated with a new aromatic diamidine compound, viz., 2-hydroxy stilbamidine, (Hydroxystilbamidine). The results were very satisfactory; all the cases fulfilled the criteria of immediate clinical cure. First six of the cases have completed the six months observation period and have remained free from kala-azar. It is very probable that these patients have been permanently cured. The observations to determine the permanent cure rate is being continued.

Another series of 16 cases of kala-azar was treated with a new antimony compound, viz., methyl glucamine antimoniate. The cases treated were mostly (12) previously untreated or ordinary cases of kala-azar. The results have been satisfactory.

The clinical details of the therapeutic trials of these two compounds are presented.

25. Search for new Antibiotic-producing Substances from Micro-organisms for Controlling Disease Producing Organisms.

P. N. NANDI, Calcutta.

Since the discovery of Penicillin, a number of potential antibiotic substances were obtained from fungi, actinomycetes, and bacteria for combating human diseases. In most cases the antagonists were reported to be normal inhabitants of soil.

The work reported here deals with the isolation of micro-organisms from peat soil, cultivated soil, and compost and studies on their antagonistic activities. The isolates were grown in liquid media and the culture filtrates assayed against *Staph. aureus, B. coli, V. cholerae* and *B. typhosa*. The strains showing positive antibiotic-activity were kept in subculture for futher study. From the results of assay it appeared that the specificity of the antibiotic-producing organisms was well-marked in several cases.

Of 540 strains of microorganisms, 36 were antibioticproducing, which include fungi, actinomycetes, and bacteria 20, 9, and 7 strains each respectively. The work is continued further and purification of the active fraction will be followed by clinical trials.

26. A Case of M. T. Malaria Resistant to Paludrine.

R. N. CHAUDHURI AND M. N. RAI CHOWDHURI, Calcutta.

The case illustrates a rare instance of natural resistance of a strain of *falciparum* parasite to paludrine. The drug also failed to cure the infection induced by inoculation of a volunteer with trophozoites. But a second volunteer inoculated with the latter's blood responded to it; he, however, had arsenical injections as well.

27. Bronchial Asthma—its Pathology and Drugless Treatment.

P. G. GOLLERPERI, Poona.

This is a detailed scheme of breath-holding and exhaling exercises for the relief of Bronchial Asthma, based on the theory that the respiratory musculature, specially the abdominal diaphragm and the smooth muscle of the bronchioles, could be educated and trained to disregard the allergic stimulation well known in the pathogenesis of this type of asthma. Certain unconscious bad habits of breathing are held to be responsible for asthma, in addition to the allergic factor. The most important of these bad breathing habits is the misuse in normal respiration, of the so-called Accessory Muscles (voluntary) of respiration of the upper part of the trunk and neck. In the male adult at any rate, normal respiration, when at rest could be best described as mainly thoracic, while it is thoraco-abdominal in the female and almost wholly adbominal in the child. Watching a sleeping child's respiratory movements this becomes very evident. Re-education specially for the Asthma subject to practice volitional abodminal breathing until it become a habit even in sleep, will make for a definite modification of the severity of his attacks. Together with this, a controlled scheme of breathing exercises, with emphasis on the breath-holding of a normal inspiration and a deep and uniform exhalation following it could be exploited in largely eliminating the attacks altogether, and a return of normal good health.

28. 17th and 18th Century Medical Books in Indian Libraries.

D. V. S. Reddy, Madras.

A recent search has revealed the existence of some 17th and 18th century Medical Books of European origin in the Medical Libraries in India. Photographs of title pages, chief contents and historical value of these old books are presented. Whereever the books are not available for detailed study lists of such old books are given. (Photographs and lists will be projected on the screen.)

There must be many other equally old books from their remnants of the Imperial library of the Moghuls or from the Royal Libraries of other Indian Potentates in 16,17,17th centuries. The Libraries of the Early European Settlements and Missions, of the Portugese, the Dutch, the Danish, the French and the English may also contain valuable early editions. An appeal is made to all Scholars and owners of book-collections, to publish lists of such old books with all the details and photographs so that a consolidated list of the early printed works on European Medicine, available in India for study, may be prepared and printed, and all these books or copies of these works may be brought together into a Central National Medical Library.

The Bibliography of Indo-European Contributions to Tropical Medicine

D. V. S. Reddy, Madras.

Most of the Histories of Medicine, written by American and Europeon Scholars, devote a few lines or a few paragraphs to ancient Hindu Medicine (Ayurveda) but generally omit to mention the great names and contributions from India to Tropical Medicine, in the 18th and 19th centuries. Still more surprising is the scant space allotted in monographs on Tropical Medicine and in books on the history of Tropical Medicine, to the large number of reports, researches, monographs and treatises, from India, by Europeon physicians and Surgeons, and specially, by that small but immortal band of British Medical Men, serving on the establishments of the three Presidencies in India. Results of a search for such books are presented—(Photopraphs and lists be projected).

Our own India and medical men of the present century in India, the teachers of our medical schools and the few investigators, scattered here and there, have not even heard of these mines of knowledge. Post-Graduate students, preparing theses for degrees, or articles to Medical Journals, are blissfully ignorant of these treasuries of clinical observations, post-mortem findings and lines of treatment. In the course of historical survey of a disease or observation of clinical interest or a drug or mode of treatment, Indian writers begin abruptly with 1900 or preface the article with the reported or distorted statements from Hippocrates, Galen, or Sydenham. It would be more in consonance with the new spirit of Free India and Indianising the studies at the University levels, if our Universities and Journals insist on the study and survey of Indian and indigenous literature, on the particular branch of Medicine or on the particular subject, under discussion. Co-operation from public and private libraries in India and abroad, of WHO & UNESCO is needed for the preparation of an exhaustive bibliography-which is bound to be useful, not only for India but for all Nations.

30. Sensitisation of Penicillin Resistant Pathogens.

MISS. MARIAM GEORGE and K. M. PANDALA, Kayamkulam.

We have previously shown that the differences in the susceptibility of certain pathogens to penicillin are associated with differences in their metabolic reactions as well as with the presense or absence of certain catalytic systems in them. Since this assumes significance with reference to the recent findings of British workers who noted the apparent transference of sensitivity from one organism to another we have extended our earlier work.

We find that the growing of penicillin sensitive and penicillin resistant organisms together causes the latter to become sensitive to the drug. Growth together for half an hours at 37°c. is in many cases sufficient to induce such sensitising effects, the acquired sensitivity lasting a fairly long time. Reversal of resistance by such simple processes as mere contact suggests that the sensitivity to penicillin depends upon a highly labile constituent of the bacterial cell. Ribonucleic acid isolated from sensitive bacterial cells such as *Staphylococcus Aureous* was able to reverse the drug resistance in the case of normally penicillin resistant organisms such as *Escherichia coli, Salmonella typhi* etc. The protein moiety of the nucleo-portein prepared from the bacterial cells possessed no capacity to induce any sensitivity.

These results suggest the possibility of reversing natural or acquired resistance of pathogens to drugs at will by suitable and appropriate treatments. The mechanism of sensitisation is not clear, but appears to be due to bacterial adaptation to fresh environments developing in the presence of sensitive organisms. These findings confirm our earlier postulate that complex catalytic systems bringing about the metabolic reactions of the various pathogens, are responsible for either sensitivity or resistance to penicillin of these pathogens and that by suitable adaptive changes pathogens could be trained to become sensitive or resistant to a drug as desired. These findings have important significance in future chemotherapy of bacterial infections.

31. Effects of Drugs on Electrocardiogram.

S. M. BANERJI, S. TEJ AND J. SENAPATI, Cuttack.

The following drugs were used and E.C.G. were taken before and after I.V. administration to human beings,

Calcium Effects were: Slowing of rate, P better by ½ mm QT Shortened by 1 mm diastole increased by 1 mm., T better by ½ mm and R2 of greater voltage 2 mm.

Novarsenobillon: Increase of rate in some P decreased by ½ mm R2 decreased by 2 mm No change in QT and ST and P-Q interval.

B. The following drugs were used to perfuse forg's heart and direct electrograms were taken:

Calcium, Potassium, Adrenalin: Show the expected results as is revealed by record of heart tracings.

Thiamin chloride:—Show initial depression followed by stimulation.

32. Clinical Pharmacology of Rauwalfia Serpentina.

NAGENDRANATH DE, Calcutta.

The action of Rauwalfia serpentina, as observed on using the drung in varying doses in over 500 patients, were:

(1) General vasodilatation noticeable on the skin, specially of the face and conjunctiva.

(2) Reduction of blood pressure when it was abnormally high to begin with.
(3) Depression of the central nèrvous system at the subcortical level.
(4) Beneficial effects on delusions.

Untoward effects observed were:

(1) Conquestion of face and conjuctiva and running of the nose.
(2) Slowing of the heart.
(3) Some difficulty in respiration.
(4) Nausea, vomiting and sometimes diarrhoea.
(5) Rigidity and tremour with changes in features and speech resembling parkinsonism.
(6) There are cases of idosyncrasy in which toxic symptoms appear even with one dose.

33. Total Phospholipoid, Choline-Containing Phospholipoid and non-choline Phospholipoid in the Serum of Normal Human subjects and in Patients with Cirrhosis of Liver.

M. V. RADHAKRISHNA RAO and N. C. DUTTA, Bombay.

Total phospholipoid, choline-containing phospholipoid and Cephalin content of the serum of patients with cirrhosis of liver has been studied and compared with those of Normal human subjects. In II normal human sera, the lipid phosphorous was, on an average, 5.87 mg|100cc serum and the total phospholipoid was 146.68 mg per 100cc serum. These values are somewhat below the average normal standards given in literature for normal persons of western countries. It was found serum phospholipoids are predominantly choline-containing type in normal persons. Non-choline phospholipoid (Cephalin) forms only a small fraction of the total phospholipoids present in the serum. These observations are in agreement with those of Entenman and others (1944). In cases of cirrhosis of liver with long-standing ascites, a marked reduction of the total phospholipoids and particularly choline-containing phospholipoids was noticed. Cephalin content of the serum, on the other hand, showed some increase over the normal values. It was found that with treatment and with partial clinical improvement, there was a decided increase in the choline-containing phospholipoids.

34. Industrial Health—a Problem in India and its Solution.

DR. S. K. CHATTERJI, Calcutta.

"Production means wealth. If we do not produce we do not have enough wealth. We must go ahead on the path of creation, construction, co-operation and good will to our brothermen. We want a stream of wealth pouring out from our fields. factories and workshops, reaching our country's millions, so that ultimately we might see our dreams fulfilled. Let us go on with the work, hard work. This production is not for enriching individuals but is to enrich the nation, that is all of us together. If India lives we also live. If India paralyses herself, then we are also paralysed. If we progress in the right direction then a time will come when we can say the truth and strength—Jai Hind."

This is really an inspiring message of our Prime Minister the Hon'ble Pandit Jawaharlal Nehru.

We are still in a period of transition and India has just made the beginning. Attention of the industrialists, capitalists and specialists are now concentrated to the creation of new industries for the benefit of the country. Attempts are being made to discover the various fields of work still untouched and to improve those already in existence. That is a pretty heavy task no doubt.

With industry coming into its own in free India, which is also intended to be a self supporting country, the problem of "Industrial Health" becomes of prime importance to build up a healthy industrial country.

This necessitates a deep study and research with thorough investigation into (1) the normal physiological conditions under which the respective industries may work and develop, (2) the toxicological manifestations under abnormal conditions (3) the diseases peculiar to a particular industry with (4) their pathological and biochemical findings (5) their possible control and remedial measures, (6) the proper food and nourishments required for each individual employed therein according to their age and sex-which also entails (7) the analysis of foods and drugs.

The normal physiological conditions under which a particular industry may work and develop depend upon its own merit and upon various factors.

The toxicological manifestations of various industries along with the various types of diseases peculiar to them are noted. Recent researches into the clinical symptoms following exposure to atomic bomb explosions or working in an atomic energy plant or with nuclear research work are also revealed. The health of the employees—either civil or military both among the ground technicians and the flying staff in the air service also deserve attention.

A through medical examination of the workers off and on, along with the biochemical findings of blood, urine, faeces, pathological and bacteriological examination of the tissue fluids, X-Ray of lungs bowels etc are essential. A control of the various hazards in different industries and their remedial measures are also of prime importance.

The treatment includes not only medicines as applicable to them but a change to a better hygienic surroundings with proper nourishments and good food as well. The deterioration of the food stuff and the medicinal preparations by adulterations entails the necessity of having foods and drugs analysed.

A well organised administrative "Industrial Department" in modified form is needed for the purpose. The Indian Union may have separate units in each of the Provinces with proper staff for supervision and improvement of her own industry. The provincial units will be held responsible for the welfare of the workers there of. Smaller units may be placed in each district and division working under control of the provincial head.

An well equiped laboratory with proper staff for the conduction of chemical, biochemical, pathological and bacteriological examination, one X'Ray clinic and one therapy clinic should be provided for each unit.

The Government, the different industrial magnets and the public should be encouraged to co-operate in this vital matter with men, materials and finance.

35. Field Application of Artificial Insemination in India.

P. Bhattacharya and S. S. Prabhu, Izatnagar.

A preliminary report on the field application of artificial insemination in India was communicated to the 35th Indian Science Congress. In the present report results of 4005 inseminations carried out of 9 different breeds and stationed at the 3 regional artificial insemination centres run by the Government of India are analysed and discussed. The cow bulls gave on an average 3.98 0.18 c.c. of semen per ejaculate with which 7.7 cows were inseminated while the corresponding figures for buffalo-bulls are 2.85 0.20 c.c. and 3.2 respectively. The largest number of artificial services per bull in the year was 720 in the case of cow bulls and 223 in buffalo bulls. The overall fertility in cows is 68.52% or 1.46 services per conception and in buffaloes 68.21% or 1.47 services per conception.

Similar analysis of the data according to the different breeds has also been worked out and discussed.

36. Effect of Muscular Exercise on Semen Production.

S. S. PRABHU and S. GUHA, Izatnagar.

The results from a preliminary experiment carried out under a general investigation taken up to study the effect of muscular exercise on the quality and quantity of semen produced have been given. 8 Kamauni hill-bulls kept under uniform condition of management and dietary regime, were divided into two groups; one group was given an hour's exercise just prior to collection while the other group received no exercise. The treatments were interchanged following the "change over" design and in all 4 collections per week for 2 weeks were studied. For each collection: 2 ejaculates were collected and studied separately. The results were analysed using the technique of analysis of variance. With the exception of semen volume which was higher (1.5 as opposed to 1.28 c.c.) for non exercise group no significant difference was observed in other seminal characters studied.

37. Secondary 'Sex-Ratio' of Normal Births in Indian Cattle.

P. BHATTACHARYA, S. S. PRABHU and S. N. CHATTERJEE.

A total of 5246 calvings from Sahiwal, 2556 from Sindhi, 2425 from Tharparker, 891 from Gir, 474 from Cross-bred Sahiwal, 1420 from Cross-bread Sindhi and 72 from Cross-bred Gir were considered. The overall "Sex-ratio" works out to be 103.93 males to 100 female births. The breed-wise "sex-ratio" is as follows:—Sahiwal—105.89, Sindhi—105.80, Tharparker—100.41, Gir—103.89, Cross-bread Sahiwal—103.43, Cross-bred Sindhi—99.44 and Cross-bred Gir—111.76.

38. Incidence of Abortion in Indian Cattle.

P. BHATTACHARYA, S. S. PRABHU and S. N. CHATTERJEE, Izatnagar.

With a view to study the rate and frequency of abortion due to all causes among Indian cattle, 13,084 calvings from 4115 cows belonging to 4 pure bred and 3 classes of cross bred milch—cattle maintained at 25 different farms in the country, were studied. Calves dropped before 262nd day of pregnancy have been considered as 'abortions. The total number of cows aborting is 508 while the total number of abortions observed is 597. On an average it was noticed that one cow in every 9 cows may abort. The number of cows which have aborted more than once is 67, which is 13.20% of the total number of aborting cows. The highest number of abortions (25.46%) occurred in the second lactation. Majority of the aborting cows (63.81%) were seen to abort in the first three pregnancies; in subsequent gestations there is a gradual fall in the incidence of abortions. Within a given gestation, it has been observed that there is a progressive increase in the incidence of abortion with advancing pregnancy—the largest number of abortions occurring in the 9th month.

The sex of the aborted calves showed a preponderance of males (males 124.68 per 100 females).

Of the different breeds studied, Gir topped the list with 11.90% abortions followed by Cross-bred Gir, Cross-bred Sahiwal, Sahiwal, Sindhi, Tharparker, Cross-bred Sindhi with 11.11%, 9.91%, 4.11% 3.22% and 2.68% abortions respectively.

39. Study of Gestation Periods of Indian Breeds of Cattle.

P. BHATTACHARYA, S. L. MUKHERJEE, and S. S. PRABHU, Izatnagar.

The average gestation periods of 4 pure and 3 grade breeds were studied. The gestation periods (in days) are as follows:—

Sahiwal — 285.93 (5246); Sindhi — 283.88 (2556); Tharparker — 287.93 (2425); Gir — 284.36 (891); Cross bred Sahiwal — 280.65 (474); Cross bred Sindhi — 286.37 (1420) and Cross bred Gir — 283.58 (72). Overall gestation periods and gestation periods for male and female births varied from breed to breed and from farm to farm; with the exception of Cross-bred Sahiwal male gestations were slightly longer in length than female gestations.

40. Successful Collection of Semen From Buffalo-Bulls by the "Massage" Technique.

S. GAJJAN SINGH, S. S. PRABHU and P. BHATTACHARYA, Izatnagar.

The paper records successful attempts made to collect semen from buffalo-bulls by massaging the ampullae of the Vasa deferentia per rectum. The Experiment was conducted on 4 buffalo-bulls, while 4 cow-bulls acted as controls. On an average, the buffalo-bulls required 10 attempts (made on different days) as compared with 3.25 in cow-bulls, before reacting to the technique. A total of 13 collections made from the buffalo-bulls gave on an average, 1.03 c.c. of semen as compared to 2.5 c.c. of cow bulls obtained from 17 collections.

41. Incidence of "Twinning" in Indian Cattle.

P. BHATTACHRYA, S. S. PRABHU and S. L. MUKHERJFE, Izatnagar

The incidence of "twining" in Indian cattle was studied in 4 pure breeds and 3 classes of cross-bred milch animals. Out of a total of 34,084 calvings examined, 28 twins birth were observed, one cow giving birth to twins in successive calvings (3rd and 4th). On an average, one cow in every 152 cows produced twins and a pair of twins was dropped once in every 485 calvings. The percentage of twin bearing cows was 0.686 and the percentage of twin calvings was 0.214. Out of the 28 twins born 14 were of like sexes (900, 5♀♀) and 12 of mixed sexes, while in the remaining 2 cases sex was not recorded. The overall mortality rate (within a few weeks of birth) is 125% in 28 twin births (28 x 2 = 56 births). The gestation periods of male and female like twins and the mixed twins are 278.8 ± 12.62, 278,6 ± 6.36 and 287.42 ± 9.56 days respectively. It has been observed that the majority of the twin births occur in the 3rd and 4th parturition.

42. Study of the Symptonms and Postmortem Lesions in Fowls Experimentally Infected with Ranikhetdisease Virus.

S. GUHA and S. N. CHATTERJEE

In connection with an attempt to raise a Ranikhet-disease resistant strain of fowls at the Animal Genetics Section of the Indian Veterinary Research Institute, Izatnagar, a large number of birds consisting of Rhode Island Red, White Leghorn and Deshi breeds, over eight weeks old, were inoculated with virulent Ranikhet Disease Virus (Mukteswar strain). This material was utilised by us for studying in details the symptoms of the disease and the post-mortem lesions in artificially infected fowls. Out of 1679 fowls injected with virus only 3 bords survived making the mortality rate 99.82%. The average survival period was 3.9 days and the peak of mortality was noticed on the

4th day. Post-mortem examination was conducted on 1644 fowls in all. The general symptoms and the post-mortem lesions have been described.

I. FOWL POX

43. Duration of Immunity Following Vaccination.

S. G. IYER, S. B. V. RAO, S. P. BERI and D. RAMNANI, Izatnagar, U. P.

The imporved vaccine against fowl pox was prepared by incorporating pigeon and fowl pox viruses. Biological tests made with the vaccine demonstrated that the vaccinated birds evinced no immunity after six months, suggesting the need for re-vaccinations.

STUDIES ON INCUBATION

44. II. Influence of egg size on Hatchability.

S. G. IYER, B. M. THAKRAL and NARAYANAN, Izatnagar, U. P.

In experiments made to study the relation of egg size or egg weight to hatchability results and body weight of the chicks hatched at day old, it has been observed that highest hatchability was obtained in the case of eggs weighing about two ounces while the hatchability percentage decreased proportionately as the weight of the eggs increased. It was further observed that as the weight of the eggs increased the average weight of the chicks also increased more or less proportionately.

45. III. Relation of egg Colour to Hatchability.

S. G. IYER, B. M. THAKRAL and NARAYANAN, Izatnagar, U. P.

In the case of Rhode Island Red breed, the colour of the egg shell is brown but experimental observations with respect to hatchability results have revealed interesting features. The brown of the individual eggs varies in shade so as to appear from dark brown to extremely light brown. The hatchability results involving the use of various shades of eggs of brown colour suggested that there was no justification for a poultry breeder to decry the use of light brown hatching eggs, thus reducing their market value. Highest hatchability results were obtained in the case of eggs of medium brown colour. Necessity for further work is stressed as the colour of the egg shell is governed by genetital physiological and environmental factors.

46. IV. Influence of Tremulous air cell on Hatchability.

S. G. IYER, B. M. THAKRAL and NARAYANAN, Izatnagar, U. P.

Experiments have been made to study the influence of tremulous or floating air cell on hatchability of Black Minorca hatching eggs which had travelled 90 miles by train. The results of incubation trial revealed that there was a definite and significant reduction in hatchability in the case of tremulous air-celled eggs as compared to normal eggs. Normal eggs have a hatchability of 73 *per cent* while in the case of tremulous air celled eggs it was 46 *per cent.*

47. I. Loss of Weight of hen eggs during Artificial Incubation.

S. G. IYER, B. M. THAKRAL and NARAYANAN, Izatnagar, U. P.

In view of the great economic importance of hatchability results to the poultry industry in the production of more protective foods, experiments have been made to study the loss of weight of eggs during the incubation period so that adequate amount of moisture can be provided in the incubator chamber. Eggs from hens of White

Leghorn and Rhode Island Red breeds have been included in the study. The results indicate breed differences and individual variations. The results also revealed that the individual variations were mainly due to the porosity of the egg shell. Infertile eggs apparently lost more weight than fertile eggs during every week of incubation. The optimal loss of weight of a fertile egg during the period of 18 days of incubation should not be more than 7.5 gm.

48. Dried cow Manure in the ration of Growing Chickens.

D. PATRHASARATHY, S. G. IYER, Izatnagar, U. P.

It has been shown by some workers abroad that when growing chickens were fed on a ration containing cow manure at about 10 *per cent.* level, the growth rate was very much accelerated. This was ascribed to the presence of some growth promoting factors in the cow manure. Parallel to the increased growth there was marked comb development also, both in male and female chickens indicating the presence of some male hormones. In an attempt to see if the undesirable hormone influence, could be destroyed by drying at 80°C. for 24 hours without destroying the growth promoting activity, the present experiment was undertaken as this would reduce the cost of feeding considerably in as much as the costly animal protein could be dispensed with. In an experiment of 8 weeks duration starting with day old chicks it was observed that in spite of drying the cow dung at 80°C. for 24 hours, the androgenic activity was not completely destroyed. Further satisfactory growth was not also obtained probably due to the destruction of the growth promoting factors.

49. Part I. Cow manure as an Ingredient of Poultry feed.

S. BOSE, S. G. IYER and H. P. TANDON, Izatnagar, U. P.

Studies have been made on the comparative efficiencies of four experimental poultry rations on comparable groups of Rhode Island Red laying birds. Group I which was fed on basal ration supplemented with meat offals showed improvement in egg production and the high egg production was maintained throughout the experimental period. Group II which fed on diet containing heat treated cowdung in the groundnut cake supplemented ration, impaired the egg production by 9 per cent of Group III which was fed on groundnut cake supplement only. The heat treatment of cowdung at 80°C. for 24 hours, therefore, failed to destroy the androgenic potency. The protein content of each of the above three rations was kept constant at 15.6 per cent. Group IV contained a lower level of groundnut cake supplement and the protein content of the ration was 13.1 per cent. The average percentages of egg production of the birds in the above four groups during eleven weeks' experimental period were 55, 34, 43 and 44 respectively. The result indicated that maintenance and moderate egg production can be supplied by rations containing less protein than the present accepted standard of 15 per cent.

The hatchability of fertile eggs in all the four experimental groups was fairly good and the feeding of cowdung did not have any significant favourable influence on hatchability. It appears that cowdung failed to show the beneficial effect on hatchability in the groundnut cake supplemented ration, because the birds used in the experiment were the progeny of hens fed on the normal balanced ration and the progeny, therefore, had not only the growth promoting factor already present in them, being transmitted from the dams through the eggs, but they were also fed on balanced ration for nine months before the commencement of the experiment.

50. Efficiency of Cocoanut oil in the Preservation of Shell Eggs.

D. B. MUKERJEE, Izatnagar, U. P.

Thermostabilised eggs when oiled retained their internal quality better than the ordinary thermostabilised eggs, on storage at room temperature (86.9°F.) for 3 weeks.

Oiling was also found beneficial in preventing undue loss of weight by storage due to evaporation of moisture.

The palatability score of the oiled eggs was higher and the flavour score slightly lower when compared to simple thermostabilised eggs. Egg spilage due to bacterial contamination did not occur at all in any of the treated eggs.

51. Effect of Vaccination on egg Production.

S. G. IYER, G. D. TANDON, Izatnagar, U. P.

Vaccination of chickens against Ranikhet disease when carried out at the age of 16 weeks did not adversely affect any of the economic characters such as the rate of growth, egg production, food utilisation for growth and egg production, fertility and hatchability. Hence, there is absolutely no justification for decrying vaccination in the case of Ranikhet disease.

52. The first outbreak of *Salmonella* infection of poultry in India.

S. G. IYER, S. B. V. RAO and S. NARAYANAN, Izatnagar, U. P.

A serious outbreak of a disease due to *Salmonella* in a large commercial poultry farm in Northern India, giving rise to a mortality of about 50 per cent of baby chicks is described for the first time.

Penetration of the organism into the shell and infection of the embryo and subsequent recovery of the organism under experimental conditions is described, demonstrating the possibility of incubator infection through contaminated egg shells. The isolation of the organism from the livers of ailing chicks, and from the ovaries of the 'Carriers' is recorded. Control measures have been detailed and the disease has so far been kept within bounds.

The field organism is readily agglutinated by the stock serum of *S.* pullorum though accurate serological typing after Kaufman-White still remains to be done.

Further spread of the condition has been checked by periodical blood testing for the removal and destruction of carriers combined with hygienic and sanitary measures.

53. The determination of the percentage of edible flesh in the Rode Island Red, White Leghorn and Desi (indigenous) cockerels at different stages of growth.

T. D. MAHADEVAN and S. BOSE, Izatnagar, U. P.

The determination of the percentage of edible flesh in the Rhode Island Red, White Leghorn and Desi cockerels at 8,12,16,20 and 24 weeks of age respectively, revealed that the percentage of total edible was highest in the *Desi* and lowest in the White Leghorn cockerels at all the stages of growth. The percentage of breast meat was, also, higher in the *Desi* than in the Rhode Island Red or White Leghorn cockerels. As regards efficiency, the three breeds ranged themselves in the following descending order: *Desi,* Rhode Island Red and White Leghorn. The conformation of the dressed *Desi,* Rhode Island Red and White Leghorn cockerels were classed as fully fleshed, fairly well fleshed and poorly fleshed grades respectively.

54. Studies in Equine Blood Groups.

C. S. BALAKRISHNAN and DR. S. N. YERAVDEKAR, Bombay,

1. Results of grouping of the blood of 611 horses mostly Indian Thoroughbreds are outlined and discussed.

2. 4 Groups, A, B, AB and O analogous to those in Human Blood are recognised to exist in horses also.

3. The distribution of these groups is peculiar and varies widely in Thoroughbred Indian Horses and Australian Horses. It is found to be as shown below:—

Indian Thoroughbred	10.2	5.7	0.4	83.7	%
Australian	8.5	24.5	8.5	58.5	%
ANIMAL:	A	B	O	AB	

4. The reciprocal relation between agglutinogens and agglutinins is maintained. But incomplete bloods such as Group B and Group O without agglutinin 'a' have been found.

5. The use of a very strong preservative namely .1% Brilliant Green and its advantage in eliminating the need for strict aseptic measures in serum preparation is pointed out.

6. A special technique of cross-matching involving serum dilution and accurate cell suspension is explained.

7. The problem of icterus neo-natorum in horses and the value of blood grouping, in advancing research on the problem are indicated.

8. The case of a Group O mare mated to two Group AB stallions producing 2 Group AB foals to one, and one group O, one Group AB, and one Group A foals to the other is reported.

9. A statistical study of the genetic aspect of the distribution of blood groups in Thoroughbred Indian Horses is made and the data are shown to be incompatible with Bernstein's theory of Human Blood Groups.

55. A Preliminary Investigation in "Bovine Lymphangitis".

D. Krishnamurty, Madras.

Although this disease was recorded in India as early as in 1908 and occurs mostly in a sporadic form in provinces situated along the east coast of the country, particularly in Madras, it has not yet passed the preliminary stages of investigation. This paper records a series of experiments conducted on some fundamental aspects of the disease pertaining to its etiology. In order to establish the relationship between the causative organisms and the disease, experiments have been conducted to prove the different stages of Koch's postulates. Subcutaneous route has been first chosen for transmission of the disease to healthy bullocks and only a local reaction—ensued after such inoculation which is in conformity with the previous findings. Different portals of infection have been tried later to produce a progressive disease similar to the natural one.

A progressive disease involving several superficial lymph glands and showing even the laminitic phase has been reproduced by one of these methods. This route has been utilised to prove different stages of Koch's postulates. A preliminary study of these organisms has indicated a close resemblance to those described by V. K. Iyer. Experiments have also been conducted on recovered animals and artificial inoculation produced the same intensity of reaction in them as in the healthy stock. In addition to the above experiments, the results of the investigation conducted on some other aspects of this disease, 'Bovine lymphangitis' have also been included in this paper.

56. A Case of Generalised Tuberculosis in Monkey, (Mecaca Sp.).

K. P. Chandrasekharan and D. Krishnamurty, Madras.

This paper records a case of open generalised Tuberculosis in a Monkey (Mecaca Sp) which was captured from the forests in Burma. The animal showed cutaneous ulcerations and several tuberculous nodules in the musculature of the right fore-limb, besides lesions in most of the internal organs. Histo-pathological examination of the lesions showed a fulminating type of tuberculosis with entire absence of giant cells or calcification. Biological test revealed that the infection was one due to Mycobacterium tuberculosis var hominis. It was considered that the route of infection in this case was the external ulcerating wound.

57. Preophylactic Canine Vaccine Against Rabies.

J. R. DOGRA, Bombay.

Attention is drawn to the importance of periodic prophylactic vaccination against rabies as an essential measure in the prevention of canine rabies in India.

A carbolished 25% sheep brain vaccine is described. It is a single dose vaccine, administered subeutaneously. Using Habel's technique for assaying the potency of anti-rabic vaccines results are given of seven different brews of the vaccine. Keeping qualities of the vaccine have been ascertained.

Preliminary experiments on dogs are recorded and lines of further work in hand are indicated to stimulate further research in this field by other workers.

58. Clinical and Haematological Studies on Aplastic Anaemia in the Tropics.

C. R. DAS GUPTA AND J. B. CHATTERJEE, Calcutta.

The term aplastic anaemia is usually defined as a severe and fatal anaemia caused by hypoplasia or aplasia of the bone marrow and characterised by anaemia, leucopenia and thrombocytopenia. The term is also applied to the cases of refractory anaemia even if there be no associated leucopenia and thrombocytopenia. The results of investigations on seven cases, six of which belonged to the former category are reported here. Excepting in one patient who was a radiologist no casual relationship would be established with the occupation. Antecedent history of malaria was obtainable in 5 patients. Enlargement of spleen and|or liver was seen in 4 cases. 5 patients were running temperature of varying degree. Total duration of illness varied from 2 months to 2 years.

Hæmoglobin values varied from 2.47 gms. to 9.5 gms. while red cell count varied from 530,00 to 2,100,000. Blood picture was macrocytic in 2 cases. dimorphic in 4 cases and normocytic in 1 case. Anæmia was associated with leucopenia and thrombocytopenia in 3 cases and with thrombocytopenia alone in 1 case. Hyperbilirubinæmia was present in 1 case who showed jaundice clinically. Myelogram showed varying degrees of hypocellularity in all the cases with absolute decrease of cells of all the types though relative increase of lymphocyte was noted in 6 cases and of late normoblasts in 2 cases. No megaloblasts was seen in any of the cases. Fractional gastric analysis was done in 5 cases, 2 showed hypochlorhydria and 3 isochlorhydria. All the cases excepting one, in which only the erythropoietic tissue was involved, ended fatally inspite of repeated blood transfusions, haematinics and supported treatment.

Comment.—Use of the term aplastic anæmia in a very wide sense for the cases of refractory anæmia is misleading. It is suggested that the term myeloplasia should be applied to such cases, restricting the use of the term aplastic anæmia to those cases in which there is involvement of erythropoietic tissue alone.

59. Sturies on oviducal alkaline Phosphatase in normal and in sex hormone treated pigeons.

AMIYA B. KAR, Calcutta.

The distribution of alkaline phosphatase has been studied cytochemically in the oviduct of normal and in the oviduct of sex hormone treated pigeons. In the oviduct of normal juvenile pigeons there is very little or no phosphatase activity. The enzyme activity is spectacularly increased in the oviduct of birds treated with estradiol dipropionate (25000 dipropionate units daily for 10 days). Testosterone propionate (2.5 mgm. daily for 10 days) is less effective in augmenting the oviduct phosphatase activty. The possible physiological role of alkaline phosphatase in the avian oviduct and its relationship to sex hormones is discussed.

60. Creepin Myiasis in Man An Unusual Case.

S. M. Ghose, Calcutta.

A rare case of human myiasis due to warble fly larva is reported. A short description of myiasis producing Diptera is given. The larva recovered has been identified as the larva of Hypoderma bovis in its second stage of life cycle. Contact with inefected cattle or resting on infested ground is probably the mode of infection. No special treatment was necessary.

61. Isolation of Active Polysaccharide Fraction from the Haffkine Plague Vaccine.*

S. C. Seal, Calcutta.

A polysaccharide yielding osazone resembling Arabinose osazone and having a melting point of 166°-168° C has been isolated from the Haffkine vaccine supernatant as well as from the specific soluble protein and to a less extent from the bacterial debris of only the protective plague strains including both virulent and avirulent organisms. It is absent in the pseudotuberculosis as well as in the non-protective avirulent plague organisms

It is therefore suggested that the specific protective substance of the plague bacillus is a polysaccharide-protein complex.

*This work was carried in 1942-43 at the Haffkine Institute, Bombay.

62. Casein Hydrolysate Agar—A New Solid Medium for the Growth of *Pasteurella pestis* and allied organisms.†

S. C. Seal, Calcutta.

The casein hydrolysate agar medium prepared by adding 2.5 per cent agar to the standardised casein hydrolysate broth containing 0.01 per cent liver extract forms a convenient and good solid medium for the growth of *P.pestis* and allied organisms.

After the agar is melted by steaming and distributed in the containers a temperature of 11°C and a pressure not exceeding 10 for 20 minutes in the autoclave have been found suitable for final sterilisation.

The obvious advantages of the medium have been indicated. There is scope to improve it for more gereralised use.

†This work was carried out in 1941-43 at the Haffkine Institute, Bombay.

63. The incidence and control of the TYPHUS group of diseases in the Armed Forces of India.

Major. C. G. J. Speechly Iamc, Poona.

(1) *Nomenclature*:—

Since the knowledge of the biological properties of rickettsiae is still incomplete, no satisfactory nomenclature can be definitely laid down but a tentative classification on

Megaw's Vector basis has been adopted by the Army in India for convenience and early notification of the disease.

(2) *Epidemiology*:—

The analysis and distribution of the various types of typhus in India have been collected from date obtained in AFA 35 (Infectious Diseases Report) Med. Directorate New Delhi compiled for all typhus cases occuring in the Army, in India.

(3) *Laboratory Investigations*:—

Here an analysis is given of the three Serological Tests used in the diagnosis of Typhus Fever viz: the Weil Felix test. Rickettsial Agglutination test and the Complement Fxation test. This is to demonstrate the efficiency of the Comp. Fixation test as compared with the others.

(4) *Preventation Measures*:—

Here such preventative measures as Vector control, Animal host control and the value of prophylactic Typhus vaccine is briefly touched on. Considerable work in this direction has been carried out recently on a large scale by the Field Typhus Team in Kashmir.

64. *Title*:—Some observations on the average normal prothrombin time.

MAJOR. B. D. P. RAO IAMC, Poona.

Experiments to determine the levels of average normal prothrombin time and the various factors affecting it, in the Indian soldiers, have been carried out in this Department. Some of the factors that have been investigated are (1) the effect of a previous meal, (2) the anticoagulant to be used to collect blood (3) time interval between the last meal and collection of blood (4) the concentration of the thromboplastic factor to be used and (5) the order in which the reagents should be mixed.

The conclusions arrived at are described and their practical significance discussed. Chylous plasma, in addition to being opaque and thus causing difficulty in noting the end-point, gives low results. Optimal dilution of the thromboplastic material seems to be a 1|20,000 dilution. Oxalate is a better anticoagulant than citrate, as with it the findings are more consistent.

65. Foreign Body Granuloma in the veins of a Puerperal Uterus Case report.

LEO KRAINER LT. COL., Poona.

A fair number of uterine veins was found obstructed by granulomatous tissue. Squamous epithelial cells and delicate (Lanugo) hairs were found enclosed in the granuloma. It is thought that these inclusions causing the granuloma are material contained in the amniotic fluid.

The findings indicate that amniotic fluid and its admixtures may enter the maternal circulation.

66. Paper on Anemia.

LT. COL. P. N. BARDHAN, Poona.

The classification and etiology of anemia are briefly reviewed. Case notes are detailed illustrating use of Folic Acid in different types of anemia.

Successful results were obtained with megaloblastic re-actions of bone-marrow. Slides of blood and bone-marrow smears will be shown.

67. Use of Stilbamidine (M & B 744) in the diagnosis of latent Trypanosomiasis in bovines.

H. N. Ray, Mukteswar-Kumaun.

The usefulness of a 10 per cent solution of Stilbamidine (M & B 744) in sterile distilled water in detecting latent cases of bovine surra caused by *Trypanosoma evansi* is described. The procedure is as follows: take 0.5 c.c. of the above solution in an agglutination tube; add one drop of suspected serum by means of a pipette. If on immediate coagulation the immediate coagulation the drop remains at the bottom of the tube and takes 5 to 10 minutes or more to dissolve the reaction is taken as positive (+ + +), but if on immediate coagulation the coagulum floats up, forms a ring at the surface and dissolves within two minutes the reaction is taken as negative (0). A positive diagnosis is also made in case the coagulum on floating begins to sink down almost immediately either in big lumps (+ +) or in small shreds (+) and finally the whole thing settles down at the bottom of the tube to dissolve within 5 to 10 minutes.

The blood sera of bovines infected with other blood protozoa such as *Babesia bigemina* and *Theileria annulata* or both and that of bovines reacting to rinderpest virus hehaved negatively.

The sera of horses and mules infected with *T. evansi* also gave negative reaction while experimentations with buffalo serum gave inconclusive results.

This test promises to be of immense value in controlling surra in this country by detecting the latent bovine carriers and their subsequent treatment with the specific drug before the fly season is on.

68. The efficacy of phenothiazine in mixed natural infection of gastro-intestinal nematodes in goats.

P. K. Sinha, Izatnagar.

Phenothiazine was tried as an anthelmintic against a mixed natural infection of mainly *Oesophagostomum, Haemonchus, Bunostomum* and *Trichuris.* The intensity of infection in the lot varied from light heavy. Three different dose rates of 0.25 gm., 0.5 g.m., and 10. gm. per pound body weight were applied to three batches of 3, 5, and 2 goats respectively. Egg and worm counts were the criterion to judge the effect of the treatment. Dosing was very quick and without slightest wastage by the use of a funnel and rubber tubing as a stomach tube. *Oesophagostomum* and *Haemonchus* were passed in large numbers. *Haemonchus* were more quickly affected than *Oesophagostomum.* Most of the *Oesaphagagostomum* were passed in the 2nd and 3rd day. On *Trichuris* the effect was very little. On *Bunostomum* the action was uncertain. The effect of 0.5 gm. and 0 1 gm. dose rates were only a little more effective than 0.25 gm. dose rate; and that was far from proportional. 0.1 gm. dose rate was not harmful. So 0.25 gm. dose rate appeared to be optimal in view of its efficacy, economy, less bulk and safety. There was greater inhibition of egg production in the surviving worms by the two higher dose rates. The excretion of phenothiazine in urine, faeces and milk continued for varying period from 5 to 10 days as indicated by the change of colour of the said materials. This period was independent of the dose of the animals.

69. Effects of Light Infection of the Fowl-tape-worm *Raillietine cesticillus* (Molin) on young chickens.

S. C. Dutt, Izatnagar.

Experiments involving parasitized and control chicks were carried out to determine the effects of light infections of *Raillietina cesticillus* on week old chicks fed on adequate diet. Cysticercoids used for infecting the chickens were grown in beetles (Coleoptera).

Effects on growth rate, mortality, feathering and on the infected part of the intestine were studied.

Effect of 5 to 36 worms with a mean of 21.6 per chick on growth-rate was found to be non-significant. 16 one week old Hhode Island Red chicks were used. Of these 8 were given an infection of 95 cysticercoids each and the rest served as control. During a period of 8 weeks the mean gain in weight of the parasitized group was 300 grams, while that of the control group was 311 grams.

Death rate of the parasitized group was found to have increased due to the intestinal obstruction by the worms.

Studies on the effects on feathering and on the infected part of the intestine were based on 18 parasitized and 10 control chicks. Retarded and poor feathering and desquamation of the jejunal epithelium were the main deleterious effects observed.

70. Legal Medicine—its study and Practice in India.

DR. S. K. CHATTERJI, Calcutta.

Of the various branches of the science of medicine—the subject of legal medicine is of no less imporance and at the same time most neglected. This subject is looked upon as one of the minor subjects in the course of study of medicine in the Indian Universities. Being engaged in the medicolegal work and criminological investigations for over 20 years I do look upon the subject not only as one of most interesting but also as one of the most important ones for the service to the State and the people.

Medical jurisprudence and forensic or legal medicine had all along been looked upon as one and the same subject—but strictly speaking they are not.

Medical jurisprudence is the branch of the law dealing with the organisation and regulation of the medical profession whereas forensic or legal medicine is the branch of medicine dealing with the application of medical knowledge to the purposes of the law.

The heavy responsibility on the part of the medical practitioners appearing in the court as medical jurists entails a thorough study of the subject of legal medicine as it is on his evidence only that the life or liberty of an individual would depend.

From the history of origin and development of the science in India, it is noted that the study and practice of Legal Medicine in India dates from the very antiquity, though of course it did not come to a stage of perfection till the 16th Century A.D. when due to the advent of many scientific researches conducted by eminent chemists and toxicologists in the West, that much advancement was made in this country as well. It was in the 19th Century that further advances were made in this direction by the discovery of the main alkaloids like strychnine, brucine, morphine, codein, conine, nicotine, atropine, hyoscyanine and aconitine etc—their isolation from crude plants and testing their chemical and physiological properties. The invention of "microchemical tests" towards the latter part of the 19th Century along with the "colorimetric" and the "spectroscopic" methods of analysis were of great help for the toxicological work to the detection of small amount of organic poisons in the human and animal tissues in cases of poisoning. The application of "electro-chemistry", "ultra-violet rays", infrared rays" or "X-Rays" in the criminological and medicolegal work are all of recent dates.

Much has been advanced in the direction of the analysis of the blood and seminal stained articles. The determination of their origin and their group tests by serological examination—are all coming to a state of more and more accuracy.

In the semen stained articles the finding of spermatozoa under the microscope either in an entire form with the head and tail or the head alone is considered as the criterion though of course some are of opinion that the finding of the heads alone should not be bases upon but there must be found the entire spermatozoa in the specimen to give a definite opinion which I should think is a baseless ground.

With the advancement of the studies and researches in the domain of physics and chemistry a rapid development of the medicolegal science is still in proguess. Newer methods and techniques are being invented in quick succession with a sustained tendency towards greater precision and reliability so that the complex medicolegal problems may be handled, in the near future, with greater case and simplicity, with less amount of labour and time, with more accuracy and at the same time with minimum cost.

In view of the importancy of the nature of work and as it is imperative on us to develop the sciences in this free India of ours—I do feel the urgency of having one "Medicolegal Institute" for each Province, with attached post mortem centre, a general laboratory, a pathological and bacteriological laboratory, a chemical laboratory and a Research section along with it—so that the whole of the medicolegal work of the Province may be conducted in the single laboratory, as is the practice in some of the Western countries.

Thus it will act not only as the controlling and guiding centre for the medicolegal work of the Province but I do believe that such work will be conducted in a smooth and efficient manner. with quick disposal of the cases and at a minimum cost. The authorities of the Central and Provincial Governments may be moved to work it out in that direction with benefit to the State and the People.

Special stress should also be made to the study of the subject of legal medicine in the Indian Universities both in the graduation course as well as in a post graduate course of training specially convened for the purpose for the benefit of the officers who would select the subject as their special profession.

71. Studies on the Specific Soluble Protein of Pasteurella Pestis and Allied Organisms.

PROFESSOR EPIDEMIOLOGY, Calcutta.

Certain chemical, physical and serological properties of the protein fractions of the plague and allied organisms precipitated from their vaccine filtrates at 1|3rd, (½-1|3) and ½ saturation of sodum sulphate have been described.

Generally, two fractions, P.1|3 and P½-1|3, were isolated from all strains grown in casein hydrolysate medium but no distilled water autolysate protein was isolated from the avirulent non-protective plague or pseudotuberculosis organisms and only a small amount was obtained from 53|Hav strain.

Most of the protein fractions isolated from the casein hydrolysate medium when dried into scales looked light brown to deep brown, the colour having probably been mostly derived from the medium. The autolysate was, however of light greyish white colour.

The solubility of these proteins was found low, usually not higher than 1 : 500. The highest solubility, 1 :200, was shown by L|auto P½ fraction. The acetic acid precipitate was relatively more soluble than the sodium sulphate precipitates. They remained as complex substance even after fractionating. The solubility could not therefore be used as a guidance for the purity of the substance.Other physical, physico-chemical electrophoretic or spectrographic examinations were necessary.

The nitrogen content varied in different fractions between 9.8 and 15.8 per cent, the highest being shown by L|auto P.1|3. On the whole, there was a progressive deterioration of the nitrogen content from the protective antigenic strain to one of extreme dissociant form of plague strain having non-protective anttigenerity. The nitrogen contents of the protein fractions from the pseudotuberculosis strains were near about 12 per cent, the P.1|3 and P½ fractions not differing from each other as in case of L|auto P.1|3 and P½-1|3 fractions.

All protein tested were Molisch, biuret, sulphur and phosphorous positive. The autolysate proteins did not give positive reactions for tryptophane or tyrosine but the protein fractions of virulent and relatively avirulent protective plague strains grown in casein hydroloysate medium contained both these amino-acids, whereas those obtained from non-protective plauge and pseudo-tuberculosis organisms contained little or none. Since tryptophane was not supplied in the casein hydrolysate medium in which it was lost during the prolonged acid digestion, it is likely that the plague organism could synthesize this amino-acid during growth.

No result was obtained when the protein solutions were tested for specific rotation.

The absorption spectra in the ultraviolet region of the quartz ultraviolet spectrograph (Carl Zeiss) yielded very interesting results. The two fractions Lauto P.1|3 and L5 P.1|3 isolated from the virulent plague strains 228 μ and 353 μ wavelengths. This bend, obtained repeatedly in the above cases, was absent in the curves given by the avirulent (protective and non-protective) plague and pseudotuberculosis strains, which were generally shifted towards the right. So far, this was the only distinguishing feature noted between the virulent and avirulent protective plague strains.

Two distinct fractions were isolated, P.1|3 and P½-1|3 mentioned as antigens A and B respectively. Serologically the P.1|3 fraction (antigen A) of the virulent and avirulent protective plague strains differed from their (P½-1|3) fraction (antigen B) and from P.1|3 and P½-1|3 fractions of the non-protective avirulent and pseudotuberculosis strains except a light cross reaction being noted between 120|5Hav P. 1|3 and L5 P. 1|3 fractions probably indicating the existence in the former of a residual antigen equivalent to L5 P.1|3. The (P½-1|3) fraction of virulent and avirulent protective plague strains cross-reacted with the P.1|3 or P(½-1|3) fractions of the non-protective plague or pseudotuberculosis strains. Thus the plague strains seem to have been related to the pseudotuberculosis strains through this fraction. The latter having reacted also with the anti-serum against boiled virulent plague strain necessarily come from the somatic part of the organism. There was no difference between P.1|3 and P½-1|3 fractions of the autolysate protein and of the non-protective avirulent plague and pseudotuberculosis strains.

The most specific antigen of the virulent plague bacillus was Lauto P.1|3 fraction. The specificity of the other P.1|3 fractions isolated from the same virulent plague strain grown in casein hydrolysate broth seemed to depend upon the quality of the medium as shown by the week specificity and broad|antigenic relationship of the L3 P.1|3 fraction isolated from the basal casein hydrolysate medium.

III. Certain chemical, physical and serological properties.

72. Biochemical Changes in blood in "Phrynoderma".

K. Rajagopal and S. R. Choudhury, Calcutta.

Hyperkeratosis follicularis has been recognised without question as a manifestion of Vitamin A deficiency. Lucius Nicholls over a decade ago gave the name "Phrynoderma" to this condition and the sign has been popularised as an index of Vitamin A deficiency in routine Nutritional surveys. Aykroyd and Rajagopal (Ind. Jour. Med. Res. 1936, Vol. 24,p. 419) however, cast some doubts on this, as a result of their nutritional surveys carried out in Malabar where they found no correlation between other signs of Vitamin A deficiency and Phrynoderma. It was suggested by them for the first time that fat deficiency might be responsible for this syndrome.

Twenty two cases of Phrynoderma and eight controls were studied (in collaboration with Dr. L. M. Ghosh of the Skin Department of the School of Tropical Medicine for the clinical part of the work) regarding the lipid constituents in blood. Serum analysis for total lipids, total chlesterol, fatty acids and iodine value of fatty acids were carried out. Individuals showing phrynoderma were dosed with linseed oil by month (3 tea spoonfuls twice a day; total of 3|4 ozs. a day) daily. Improvements as visible by the unaided eye was noticeable in two weeks and cure resulted in four weeks to twelve weeks. The iodine value of fatty acids which were strikingly lower than in controls returned to normal after treatment with linseed oil. It can therefore be surmised tentatively that 'phrynoderma' is perhaps due to insufficient amount of unsaturated fatty acids available to the body. The figures below give the averages of the lipid analysis of blood.

In mg. per 100 c.c. serum

			Control	Before treatment	Phrynoderma after treatment
Total lipids	..	..	442	427	487
Total cholesterol	..	..	134	145	140
Total fatty acids	..	..	308	270	356
Iodine number of fatty acids		..	112	02	112

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SECTION OF ANTHROPOLOGY & ARCHAEOLOGY

President : Dr. C. Von Furer-Haimendorf, Ph.D.

PREHISTORIC AND PROTOHISTORIC BELLARY

B. Subba Rao, Poona.

This paper incorporates the results of an intensive study of the Bellary region, which is considered to be "the pivot of the Lower Deccan" and a corridor for the migration of cultures, on account of its being an area of maximum inter-communication in South India. The systematic exploration in the district and the excavations conducted by the writer at Sangankalu and by Dr. R. E. M. Wheeler at Brahmagiri have enabled us to correlate the Prehistoric and Early Historic cultures in the heart of the Deccan peninsula.

The following is the main sequence of cultures in the region :—

(1) Palaeolithic with two distinct industries, whose relation remains to be established ; Abbevillo-Acheulean hand-axe industry and a Pebble industry resembling the Sohan.

(2) A Proto-Neolithic industry represented by crude microliths of quartz and heavily patinated flakes of trap and sandstone.

(3) An early neolithic represented by patinated chipped and ground celts, and the other tools.

(4) Late Neolithic represented by fresh chipped and ground tools.

(5) "Early Chalcolithic stone age' characterised by the occurrence of copper.

(6) Megalithic cultures over-lapping into the Satavahana period. (Illustrated)

BLOOD-GROUPS IN INDIA

(Bihar, Maharashtra and Kerala)

I. Karve and V. M. Dandekar, Poona.

About 2,000 people were examined in each of the areas named In all, 6,000 people were examined. The sample of 2,000 for each region is distributed among various castes and tribes. The differences in the gene frequencies within a region and those found between the regions are discussed. The paper deals with the A, B, O, system of blood-groups only.

THE LITHIC TOOL INDUSTRIES OF THE SINGRAULI BASIN

V. D. Krishnaswami and K. V. Soundararajan, Madras.

The paper incorporates the results of the recent (April, 1949) Prehistoric Expedition to South Mirzapur (U.P.). Ever since the casual reference to this site situated upon the fluviatile gravel bed resting over the Talchir boulder conglomerate of Permo-Carboniferous glacial origin, in this region by J. Cockburn in 1883 none had attempted to visit much less to explore this inaccessible region.

The collection of palaeolithic tools which are described and classified in this paper, shows, that it is essentially a biface core industry, with a feeble representation of the pebble facies. The chief tool families comprising this industry are the pebble choppers ; Abbevilleo-Acheulian coups-de-poing and cleavers of the straight edged, asymmetric oblique edged, and triangular types, employing the Attrampakkam (Vaal) technique ;

core and discoid scrapers; flake tools of the proto-levallois type with the striking platform angle ranging from 90° to 125° and some having battered as well as truly facetted right angled platfroms; as also delicate end scrapers. Apart from these, there is a large number of reject flakes in the collection.

Owing to the presence of the palaeolithic tools in the polygenetic gravels of the glacial moraine the exact stratigraphic relationship of this implementiferous fluviatile gravel with the Talchir glacial boulder bed is not clear even though the typological study of the quartzite tools indicates that the industry ranges from early to the middle palaeolithic period.

A microlithic industry in quartz without pottery was discovered by the first author about 4′ in the alluvium from top. The antiquity of this is likely to be mesolithic and the industry is characterised, by parallel sided blades, lunates and points.

STONE AGE CULTURES AND CLIMATIC PHASES IN NORTHERN GUJARAT

H. D. Sankalia, Poona.

The field studies of Professor F. E. Zeuner of the rivers of Northern Gujarat indicate that the Sabarmati Abbevillian-Acheulian industry probably belongs to the first wet phase in the Middle Pleistocene. This was followed by a series of two or three drier and wetter phases. During the wet phase preceding the present drier phase, a microlithic industry probably of the Mesolithic Period flourished in Gujarat. (Illustrated.)

BLOOD GROUPS FROM THE ANDAMAN AND NICOBAR ISLANDS

S. S. Sarkar, Calcutta.

During the year 1948 in course of an anthropological survey of the tribal population in the above islands, a number of individuals from the following tribes were serologically grouped. They are as follows :—

		0	A	B	AB	Total
ONGES	..	5	23	2	4	34
JARAWA	..	1	—	—	—	1
ANDAMANESE (Proper)	..	2	12	5	2	21
NICOBARESE	..	117	5	14	0	136

Racial affinities of the Negritos and the Nicobarese have been discussed in the light of the above data.

BLOOD GROUPS OF THE BHILS

Uma Bose, Calcutta.

A survey was undertaken by me in the summer of 1948 among the Bhils of Dhar, Mandu, Sardarpur and Bagh. 534 Bhils were grouped serologically. The percentage of the different groups are as follows :—

0 34.64% ; A 28.09% : B 28.09% and AB 9.18%.

The value of p, q, and r are .203, .203 and 0.589 respectively.

The Bhils grouped by Majumdar from Rajpipla, Panchmahal and Khandesh show analogous results.

The Bhils of Nimar who were grouped by Macfarlane (1941) show a considerable difference in their blood groups from all the above samples. Reasons for this divergence are discussed.

Interesting result about the concurrence of serological and linguistic alignments of this tribe is noteworthy.

ANTHROPOMETRIC STUDY ON THE SIKHS OF THE PUNJAB

P. C. Biswas, Delhi.

In this paper the author has incorporated the results of his study on the physical characters of the Sikhs of the East Punjab area. It is based upon the somatometric measurements of 100 male adult Sikhs of that area.

SOMATIC AFFINITIES AND THE RACIAL COMPONENTS OF THE KOLS OF THE CENTRAL PROVINCES OF INDIA

B. K. Chatterjee, Calcutta.

Somatic measurements and observations were taken on 127 male adults and 24 female Kols of the Central Provinces of India, particularly of the Jabbulpur area, during the summer of 1938. The analysis of the somatic data revealed that the basic somatic characters of the Kols are as follows: short stature but having well-proportioned body. The forehead is not very high and the supra-orbital ridges are not very marked. Root of the nose is depressed, and platyrrhinic except when mixed with a higher type. Lips are thick and the chin is retreating. Skin colour is of deep chocolate brown and the eye colour is of dark brown but the form is slightly oblique.

MANUAL DIGITAL FORMULA OF MAN

S. R. Das, Calcutta.

Three different digital formulae have been recorded by the anatomists who have based their conclusions upon the relative positions of the tips of the digits when the manus is laid flat and held right along the long axis. Wood Jones has termed the hands with a formula $3>4>2>5>1$ as primitive, those having the formula $3>4>2>5>1$ as simian and those having the formula $3>2>4>5>1$ as distinctively human.

In course of our studies of the human hand with the help of X-Ray skiagrams, we found that the total lengths of the three phalanges as measured from the base of the proximal phalanx to the tip of the terminal one, show that all the three types of hands mentioned above can be brought under a single skeletal digital formula of $3>4>2>5>1$.

KADAR—SEMANG AFFINITIES

U. R. Ehrenfels, Madras.

Dr. B. S. Guha's establishment of the Negrito strain in the racial configuration of various South Indian hill tribes and also population groups in the plains suggests a racial affinity between the KADAR and the Negritos of Malaya. This racial element is particularly noticeable among the Kadar of Cochin.

1. The ecological basis of Kadar life is a food-gathering and semi-nomadic economy and its technical aspect : leaf-shelters, digging stick, former use of bow and arrow, bark and leaf-dress, bamboo-vessels and tools ("Bamboo-Civilisation"). The similarity of these with the Semang Negritos of Malaya find a particularly clear-cut expression in the stylistic, technical and accidental characteristics of the bamboo combs, such as are being produced and used by both the groups.

2. The social organization is essentially bilateral, among the Kadar, as it is among the Negritos.

3. The religious aspect : a complete Kadar World Creation Myth has been detected. In the course of its description four points will be stressed as relevant to the problem before us ; (1) Subterranean Residence of deities, (2) Subterranean Rising of the Waters, connected with deities, (3) Predominance of the female element in the conception of the primordial deities, (4) Changes in the structure of the earth, owing to the action of deities (and the rising of subtreranean waters).

These more than merely accidental similarities in the original mythology of the two groups strengthens the probability of their common origin.

STRUCTURAL FEATURES OF THE KONDH KINSHIP TERMINOLOGY

Gautamsankar Ray, Calcutta.

Very little has so far been studied regarding the kinship terminology of the Kondhs. As regard previous works, excepting the list of kinship terms given by Sir H. H. Risley, practically there is nothing worth mentioning. Further Risley's list is inadequate and cointains some irregularities. This article, which is based upon the kinship terms collected genealogically from Dakpal (a village near Phulbani, the head quarters of the Phulbani District of Orissa), shows the characteristic features of the kinship terminology of the Kondhs of Phulbani area.

SOME OBSERVATIONS ON THE CLASSIFICATORY SYSTEM AS SEEN IN NORTH INDIA AND SOUTH INDIA

Hilda Raj, Delhi.

Classificatory system a feature of society in India.

A general survey of the classificatory system in North India and in South India

Method of grouping relatives on the basis of Kinship.

Kinship terms used in the North and in the South.

Kinship with reference to marriage.

Restrictions and preferences.

Cross cousins and parallel cousins.

Difference between the classificatory system of the North and of the South.

MARRIAGE RULE AMONG THE URALIS OF TRAVANCORE

Bhabananda Mukherjee, Calcutta.

The Uralis inhabit the high hills of north Travancore. Their typical tree houses (*Eru-madam*) can even now be seen in some places.

The characteristic feature of Urali marriage is that it is practised by exchange only. This is called '*Kodutu-marunattu*', meaning barter. The traditional form is to get a wife in exchange of a sister. Previously it was possible to get as many wives as the number of sisters one had. One having no sister remained unmarried. Now the Uralis give any female relation in exchange for a wife.

THE VILLAGE ORGANISATION OF THE KANNIKARS

Jyotirmoyee Sarma, Calcutta.

The Kanikkar tribe sparsely inhabits the reserved forests of the southern and the central sections of the Travancore State. Small groups of Kanikkars stay together in certain well established settlements, the internal appearance of which vary.

In each settlement there is a headman who is recognised as the leader both by the Kanikkars and the forest officials. The headman knows the rules of the important ceremonies and sees that they are kept. He also looks after the welfare of the community, and appeals are brought to him to settle grievances. The power of the headman, however, is not autocratic. The elder man of the community may advise him in regard to all situations, and the headman may change his plans accordingly.

An important aspect of the lives of the Kanikkars is the work to be performed by them for the State. The forest officials give instructions to the headman as to when the work is to be done. The headman passes out the instructions to all and supervises their work.

A NOTE ON AN AUTOMATIC FISH NET—THE KAIJAL

Minendra Nath Basu, Calcutta.

The Kaijal— a kind of automatic fish net collected by the writer from Durgapur village in the district of Jessore, now East Pakistan—a detailed ethnographic account of which is given under the following headings :—

I. Name, Locality, etc.

II. Appearance.

III. Manufacture—including materials, construction, place and time of making, maker, etc.

IV. Utility—Functions, methods and variations in use, place and time of use, user.

V. Length of Life.

VI. Ownership.

VII. Economic value.

WEAPONS OF WAR AND CHASE OF THE ABORS

Sachin Roy, Calcutta.

In this paper an attempt has been made to study the weapons of war and chase of different sections of the Abors of both the lower and upper regions, extending from N.E.F. of Assam to Tibet Border. This paper deals with : (i) different methods of manufacture of different kinds of weapons used in war, (ii) Poisons of different kinds used with their method of collection, preparation and application of the same on different weapons, (iii) Sex restrictions on the use, manufacture and possession of war weapons. (iv) Right of ownership of the weapons. (v) Use of the weapons of war in the lower region, where the tribe has long given up fighting. (vi) Lastly the paper deals elaborately with the description of each of the weapons with their measurements, methods of use, and the distribution of the different types of weapons among the neighbouring tribes. (Illustrated.)

A section of the paper deals further with different methods of war and chase with different types of weapons used and the ceremonies observed during, before and after the war.

ABOR HOUSE TYPE

Nilima Majumdar, Calcutta.

(Communicated by Dr. S. S. Sarkar)

The paper deals with the description of Abor house. The Abors generally build their houses on slopes of the hills and on platforms. The materials generally used, are, wood, bamboo, cane leaves, palm leaves and cane strips. No iron nails or iron beams are used. The tool that is generally used for the construction of the houses is a 'Dao'. The method of construction is almost similar in different sections of the Abors except in the use of different types of leaves for the construction of the roofs. The house is usually a rectangular type with a single room and a verandah. The re-construction is generally done after four or five years. The construction of the house is generally followed by a simple feast accompanied by a chorus, called 'Bari'. There are dortmitory houses "Mosups" for males and "Rasengs" for females. They are different in the construction from that of the dwelling houses.

AGRICULTURE AMONG THE PADAM ABORS

B. C. Gohain, Calcutta.

(Communicated by Dr. S. S. Sarkar)

The paper deals with the agriculture of the Padam Abors—a tribe living on the Tibeto—Assam border on the north-eastern part of India. The Abors are essentially an agricultural people—and the method by which crops are raised is the 'Jhumming' whereby forests are cut and fired and cultivated for two successive seasons before they are allowed to lie fallow for a cycle of years which varies from 9 to 15 years, i.e., accoding to the amount of arable land available to each village.

CLEANING AND PRESERVATION OF LEATHER MATERIALS IN MUSEUMS

Minendra Nath Basu, Calcutta.

This paper deals with the various causes of decay of leather and also with prevention of the causes of decay. Besides various preservatives used by different museums, applications of some indigenous products are also discussed.

Experimental results of 20 leather specimens with different preservatives are also tabulated.

SECTION OF GEOLOGY AND GEOGRAPHY

President :—J. Cates. A.R.M.S., F.G.S.

PETROLOGY

1. A Note on the Reaction Rims in the Olivine meta-norite of Hirapur, Dhanbad.

Y. K. Agrawal, Dhanbad.

The paper gives a description of beautiful reaction rims in olivine meta-norite of a hillock in Hirapur, Dhanbad. Two zones of reaction rims have been observed. The inner one is colourless and consists of enstatite the other one makes the outer green zone and is regarded as being fibrous alkali hornblende. The presnce of the green zone has been observed only where plagioclase felspar comes in contact with olivine or biotite. With the former both the rims are generally, observed whereas with the biotite only the green rim is common.

The rock consists of rhombic pyroxene (hypersthene) diallage, olivine and plagioclase felspar with biotite, magnetite and apatite as accessory minerals. Hypersthene is full of dusty inclusions and is distinctly pleochroic from pinkish to colourless. Sometimes schiller lustre is also observed. The diallage is grey coloured and it is also full of opaque inclusions but is non-pleochroic and shows very fine parting lines parallel to 010. Some of the pyroxenes are recrystallised and are clear of inclusions. The plagioclase shows very fine clouding and zoning. It is found as laths and approaches labradorite in composition. The author considers these reaction rims to be of secondary origin formed during injection metamorphism. The locality from which this rock has been described is quite close to the Damodarpur hillock from which the 'Rapakivi like structure'—a product of felspathisation—has been observed in epidiorites and injection gneisses by N. L. Sharma and Y. K. Agrawal. It is considered that both the structures may be connected with different phases of the same injection phenomena and hence these rims are not strictly corona rims but should be termed 'Relyphitic borders' a term suggested by Schrouf in 1882 for reaction rims of secondary origin due to metamorphism.

2. On the Thermal metamorphism of Impure Dolomitic Marbles in an Area N. W. of Raghunathpur in Northern Manbhum.

A. K. Bhattacharya, Banaras.
(Communicated by D. K. Chakravarti.)

Calc-silicate rocks are exposed as a few, narrow, steeply dipping and isolated outcrops in an area in N. Manbhum, N. W. of Raghunathpur defined by parallels of 23°35′ & 23°38′ N. and meridians of 86°34′ & 86°42′ E. The associated rocks are hornblende-schists, biotite-schists and quartzites of Dharwar age. A small outcrop of porphyritic granite-gneiss occurs near to these rocks in the western portion of the area, while the more or less batholithic exposures of the same rock are found 5-6 miles to the south. The present paper embodies the results of the investigations carried out on the impure dolomitic marbles subjected to thermal metamorphism, presumably due to the grante pluton. A more or less granulitic association of diopside, anorthite, tremolite, sphene, wollastonite, forsterite and calcite in the decreasing order of abundance, is found in the rock nearest the contact, while in the rock a little further away, proportions of diopside and wollastonite increase with a corresponding decrease in those of anorthite and sphene. Still father away from the contact, calcite and tremolite are likewise absent, while the proportions of wollastonite are still more increased with correspondingly marked decrease in those of anorthite and sphene. This shows that wollastonite, in the presence of impurities and under suitable temperature conditions, must have been used up in the formation of other silicates like anorthite, sphene and diopside. The presence of wollastonite ane anorthite in the same rock may represent a false equilibrium as suggested by Harker,

3. A Study on the Gneissose Granites and Associated Metamorphic Rocks of Lohaghat, Almora District.

A. D. Kharkwal, Banaras.
(Communicated by D. K. Chakravarti)

The area covered by this paper lies in the Lohaghat subdivision of Almora District (29°30′ ; 80°00′). The Lohaghat hills form part of the Nag Tibba range of the Lesser Himalayas.

The rock types met with in the area are varieties of gneissose granites, shale and schists. Veins of pegmatites and a band of pyroxene granulite have also been encountered at certain places. Two varieties of gneissose granite have been recognised, viz., the foliated variety and the augen variety. It is the foliated variety which is well developed in this area. It occurs flanked by shale on one side and by schists on the other.

The theory that the gneissose granite of the Himalayas has resulted from the metamorphism of sedimentary rocks is no more tenable. The gneissose granite of Lohaghat is of igneous origin, having developed its foliation, as a result of pressure prior to final consolidation.

The granite has produced marked effects on the adjacent rocks. The shale has been considerably silicified and feldspathised. The schists, on the other hand, have been hybridised by the lit-par-lit injection of the granitic material along their foliation planes. The schists have also undergone contact metamorphism but it does not form a very distinct progressive aureole. It is marked by a wide garnet zone. The augen variety of gneissose granite is interbedded with the schists, and in the field it does not show any connection with the foliated variety. But a petrographical study reveals a genetic relation.

It is not possible to assign any definite age to the granite, because of our imperfect knowledge of Himalayan geology. However, from tectonic consideration, it appears that it is possibly younger than Lower Palaeozoic.

4. Sylhet Trap.

A. B. Das Gupta and V. B. Rao, Digboi.

The stratified traps exposed along the southern edge of the Shillong plateau, named by Medlicott as 'Silhet trap', consists of a series of sub-aerial lava flows which show different degrees of alteration. The common rock types include amygdaloidal and porphisitic basalts and dolerites.

The Sylhet Trap appears to be similar, in texture and composition, to the Deccan Trap and to some extent Rajmahal Trap also. It is interesting to note that pegionite and palagonite which are known to be characteristic of the basalts of the Deccan Plateau are fairly common in the basaltic rocks of the Sylhet Trap.

5. Petrological Studies of Rocks of Borabudur, Java.

C. Mahadevan and N. Sathapathi, Waltair.

A few rock specimens along with two samples of earth, one pebble with a white surface encrustation, and one sample of saline efflorescence obtained from the famous Borabudur monument, were given by Mr. K. R. Sreenivasan, M.A., Superintendent of Archaeology, Government of India, for examination and report.

The monument, from which the above materials have been taken, is built on the summit of a hillock with a central mound. This central mound is cut in to terraces of diminishing size from base to top and cased with massive and well cut stone masonry. The monument is leaky and water sinks through the pores and joints of its structural blocks which are a kind of vesicular volcanic rocks.

The specimens were studied by physical, microscopical and, qualitative and quantitative chemical methods. The results of the quantitative chemical analysis have been graphically represented. The results of these investigations have yielded the following information, The rocks are of andesitic composition belonging to the pacific suite and most probably obtained from the andesitic lava beds of the area. They do not show any appreciable amount of alteration and the saline efflorescence is carbonate of lime deposited by percolating water which might have brought it either from the decomposed central core of the mound or from the lime mortar packing, if any, employed during the construction. However, there is no indication to show that the saline efflorescence has been derived from the decomposition of the structural blocks.

So it is concluded that the structural material of the monument does not show any signs of decomposition. Suitable measures may be taken to prevent rainwater sinking into the monument.

6. A Comparative Study of the Trap Rocks of the Shimoga and Chitaldrug Schist Belts, Mysore State.

C. S. Pichamuthu, Bangalore.

The Shimoga and Chitaldrug Schist Belts are two of the most prominent Dharwar bands in Mysore State. Forming part of these schist bands are basic flows and intrusions which have been described as traps. In the Shimoga Belt, there are the Lingadhalli and Santaveri traps, and in the Chitaldrug Belt, there are the Jogimardi, Chitaldrug, and Bellara traps.

In this paper, petrographical descriptions of these rocks are given. Seven chemical analysis of the traps have been used for the study of their petrochemistry. The C.I.P.W. norms, Niggli values, Basis molecules, and Kata-molecular norms have been calculated. Four diagrams in which recalculated values are plotted serve to bring out the points of similarity and divergence.

7. Spheroidal Weathering at the Waltair Coast.

N. Sathapathi, Waltair.

Various views have been advanced in recent years to account for the spheroidal weathering of rocks. The author has studied in detail spheroidal weathering observed in the charnockites of the Waltair Highlands and charnockite stacks along Vizagapatam beach and comes to the conclusion that causes like formation of new minerals such as crystallisation of salts in the microcrevices of rocks and simple hydration of mineral constituents of rocks are also capable of bringing about spheroidal weathering.

An attempt has also been made in the paper, to interpret spheroidal weathering in the light of fabric study of the fracture planes and contact planes of mineral constituents of the rock.

By such a study, it was found that the develpment or the non-development of shells in the process of spheriodal weathering is controlled by the ratio of the intermolecular cohesion of minerals and cohesion at the contact planes of minerals. To a certain extent, this is also controlled by the granularity and size of the rock.

8. A Note on the Cordierite-bearing Vitrophyric and Hornfelsic Rocks of the Ramnagar Area, Raniganj Coalfield.

N. L. Sharma, Dhanbad, *and* R. C. Misra, Lucknow.

These rocks are associated with the burnt outcrop of the Laikdih coal seam of the Ramnagar area. They are dark coloured, compact or vesicular, rocks resembling hornfels and vitrophyre in hand specimens. Under the microscope, they show a remarkable development of idioblastic cordierite. The mineral occurs as fantastically shaped crystals wrapping round or enclosing, partly or completely, the glassy matrix. It exhibits a strong tendency to develop idioblastic crystals, showing square, rectangular, lath-shaped and hexagonal sections, retaining still in the core the glassy matrix oropaque inclusions. In some varieties, the cordierite crystals have been able to clear themselves of these inclusions. The groundmass of these rocks is dark grey or yellowish brown in colour, and is often devitrified showing dendritic rods of magnetite and colourless needles of nascent cordierite. Pink or purple spinel occurs in the groundmass as small interspersed grains, and sometimes octahedra of it are observed as inclusions in the otherwise clear cordierite crystals, Xenoliths of rounded granules of quartz are common in these rocks, Specimens of rocks resembling blue spherulitic obsidian, black glassy obsidian and dark vesicular pitchstone have also been collected. The blue rock shows under the microscope dark brown and yellowish brown bands, the latter are fluorescent, showing yellowish brown colour in transmitted light and blue in reflected light.

All these rocks have evidently been produced as a result of the vitrification of the shales of the Barakar series by the intrusion of the mica-lamprophyre associated with the Laikdih seam. A detailed study of the specimens is in progress.

9. Myrmekitic Structure in the Granites of Bagru Plateau, Lonardaga, Ranchi District.

R. C. Sinha, Banaras.
(Communicated by D. K. Chakravarti)

The writer wishes to record here for the first time the occurrence of myrmekitic structure in the granites of the Bagru Plateau to which no reference has so far been made. Megascopically the rock is leucocratic, medium to coarse grained with highly altered felspars. The flakes of biotite are also promimently visible to the naked eye. The sp. gr. is 2.62. Under the microscope the minerals recognised are quartz, orthoclase, oligoclase, biotite, chorite, apatite, kaolin and sphene. The quartz with its usual characters occurs as xenomorphic crystals and as lace-like vermicular intergrowths with the oligoclase thereby showing the myrmekitic structure. Orthoclase is altered to kaolin and appears to be replaced by oligoclase showing lamellar twinning and extinction angle varrying from 8 to 12°. Besides, the orthoclase pieces are still found lying by the side of the oligoclase with typical quartz inclusions. Laths of biotite are also found adjoining such felspar pieces. The percentage composition of the various minerals in the rock is as follows :—

Quartz	33.70%	Oligoclase (and secondary albite)	24.50%
Orthoclase ..	27.70%	Biotite	6.31%
Accessories ..	6.8		

The development of myrmekitic structure is ascribed to different processes by different authors such as Sederholm, Holmes, Bowen, Alling, etc. In view of the microscopic observations recorded here the present author feels that these intergrowths of vermicular quartz and oligoclase are due to albitisation caused by hydrothermal solutions as advocated by Holmes.

10. On the Occurrence of Gabbro at Dhab, Hazaribagh District, Bihar.

R. C. Sinha and V. D. Shukla, Banaras.
(Communicated by D. K. Chakravarti)

This paper records the occurrence of gabbro at Pandaria near Dhab (24° 35′10″ ; 84° 45′30″), a mica-mining centre situated at a distance of 22 miles from the Kodarma Railway Station (E.I.R.). The rocks are exposed over an irregular elliptical area, one mile by half a mile. Other rocks in the adjoining area are epidiorites, granite-gneiss and schists.

Megascopically, the rock is dark in colour with tabular pieces of hornblende and white to grey looking interstitial plagioclases. It is a holocrystalline, coarse to medium-grained rock with a specific gravity of 3.00.

Under the microscope the texture is coarse-grained, hypidiomorphic and equigranular, the size of the grains is between 5.5 and 6.5 mm. The minerals are labradorite approaching bytownite, hornblende, biotite, albite, seconday quartz, iron-ore, orthoclase and epidote along with other accessories. The micrometric analysis gives the percentages of the above-mentioned constituents as :—

Labradorite—	44.75% ;	Hornblende—	40.54% ;	Biotite—	1.48% ;
Albite—	4.65% ;	Quartz (secondary)	3.67% ;	Iron-ore—	1.42% ;
Orthoclase—	1.33% ;	and Other accessories—	2.27%.		

The chemical analysis of the rock is as follows :—

SiO_2	.. 50.12	Al_2O_3	.. 17.86	Fe_2O_3	.. 2.18
FeO	.. 7-93	CaO	.. 12.03	MgO	.. 4.69
Na_2O	.. 2.95	K_2O	.. 0.83	H_2O	.. 4.69

It compares well with the mean of the average analysis of 41 gabbros from different parts of the world.

11. A note on the Petrology of the Basic Intrusive Rocks of Gomoh, Bihar.

N. V. R. Subrahmanyam, Dhanbad.
(Communicated by N. L. Sharma)

The area just north of Gomoh Railway Station (on the E.I.R. Grand-chord line) has been surveyed geologically. The country rock is greyish-pink and much weathered felspathic and hornblende granulitic gneiss, occupying low-lying tracts in the area. The predominant direction of strike of the country rock is east-west but it is locally affected by the larger intrusives. The country rock is much foliated, the plane of foliation dipping slightly from vertical towards north.

The basic intrusives in the area stand out prominently as hills. One such hill, extending east-west for about one and half miles, occupies a central and prominent position. Other hilly outcrops are comparatively small but are conspicuous in ranging themselves in a detached fashion, around the main hilly prominence, suggesting more or less the shape of ring-dyke-like intrusions.

The hilly outcrops are composed of dark and compact rocks, which on closer examination reveal heterogeneity in the granularity, mineral composition, and degree of metamorphism. These intrusive basic rocks include rock types such as meta-gabbro and meta-norite, meta-dolerite, epidiorite hornblende schist and pyroxenite, not only exhibiting different stages in the metamorphic processes of mineral transfromation, recrystallisation and granulitisation among themselves, but also revealing certain stages in the process of hybridisation. A low hillock, north of the main hill, consists of quartz-schist, which is considered to be a metamorphosed intrusive quartz vein.

Correlation of the different intrusive rocks based upon their field relationships, chemical composition, mineral assemblages and degree of metamorphism, is under active investigation.

12. Heavy Mineral Sorting.

V. B. Rao, Digboi.

During the examination of the samples collected for determining the heavy mineral assemblage, several thin dark coloured layers, abnormally rich in heavy minerals, were noticed in some of the samples from the Dhekiajuli Beds of Upper Assam, which appear to be referable to the Dihing Series. These dark layers contain as much as 30% of heavy mineral residue, compared with an average yield of between 2 and 4% from samples which are devoid of dark layers. Such concentration or 'flooding' appear to be due to frequent agitation, by water and/or wind currents, of the superficial layer of a shallow water fluviatile formation, during deposition.

In spite of the concentration of heavy minerals in the darker layers of the rock samples, there is a large reduction in the proportion of some of the diagnostic heavy minerals, like, Hornblende, Epidote, Hypersthene, etc., which are usually present in fair quantity in the lighter layers of the same rock. Comparison of analyses of samples from the dark and light layers of the same rock suggests that this diminution in the proportion of the diagnostic minerals is due to a large increase in the proportion of the heavier opaque minerals like Ilmenite and Magnetite in the darker layers. It is, however, interesting to note that there is practically no change in the percentage of Garnet, which has a specific gravity intermediate between that of the 'opaques' and the other diagnostic heavy minerals listed above.

ECONOMIC MINERALS

13. Study of Ore Minerals by the "Contact Print" Method.

N. N. Chatterjee, Calcutta.

The important properties hitherto used for the identification of opaque minerals under the reflecting microscope are colour, hardness, isotropism, anisotropism, reflecting power, electrical conductivity, etch tests, micro-chemical tests, staining tests etc. But each of the above properties has limitations in its application for specific identification. Moreover, it is not possible to localise the elements in the specimen. By following the new "Contact Print" method the localisation and distribution of the elements in a specimen can be done and preserved for future reference. Coloured contact prints will show faithfully the location and distribution or different elements in different colours. Another advantage of this method is that even in the grains of very small size say 200 mesh the elements can be detected by coloured prints.

The work in this new line was done in the Mining Geology Dept. of the Imperial College of Science, London, under the guidance of Prof. D. Williams. The author remains in deep debt of gratitude to Prof. Read and Williams for giving him all facilities in the laboratory. Thanks are also due to Mr. Nakhla for his constant help. The electrographic process was employed in all cases to get the best results and bakelite graphite mix was used for mounting specimens.

Results of experiments on minerals like niccolite, pentlandite, pyrrhotite, chalcopyrite, cobaltite, violarite etc. are given in the paper. The attacking and specific reagent for nickel was ammonia and alcoholic solution of dimethylglyoxime and pink coloured print was obtained. The reagent for copper was ammonia and alcoholic solution of alpha-benzoinoxime and green print was obtained. The reagent for cobalt was ammonia and alcoholic solution of benzinediazole and violet colour was produced. The reagent for iron was dilute nitric acid and sulpho-salisylic acid and violet coloured print was obtained. The period of digestion of the photographic paper in the reagents was 60 seconds in all cases and the period of contact varied between 25 and 30 seconds. Electric current of 6 to 12 volts was applied. The coloured prints will be exhibited at the meeting.

14. A Comparative Study of a Sample of Lignite from Jodhpur, Rajasthan.

P. K. Chatterjee and R. B. Ghosh, Calcutta.

An occurrence of lignite has been recorded while digging a well on the Orllagi-Undra Road near the Jodhpur-Jaisalmer border. This place is about 40 miles west of Sheo (26°12′ : 71°15′) on the north-western part of Jodhpur State.

A well of 3 feet diameter was sunk up to a depth of 350 feet from the surface and the lignite bed was struck at an approximate depth of 330 feet continuing for another 10 feet down below. A sample of this lignite, obtained through the courtesy of Mr. S. K. Borooah, formerly Director of Mining and Geology, Jodhpur State, has been studied in the laboratory of the Geological Survey of India. The material is hard and massive with dull black colour and shining lustre. It has a specific gravity of 1.25. When broken it gives rise to conchoidal fracture and thin laminations are seen. Woody texture is still visible. On chemical analysis it gives the following : Moisture—13.68% Volatile matters—39.28% ; Fixed Carbon—40.92% and Ash –6.12%. From this it appears that the material has a fairly high volatile content but remarkably low ash. A comparative study of the characters of this material with those obtained from other occurrences in India has been made.

15. Occurrence of Sedimentary Clay in the Neighbourhood of Baldekhal and Champamura Hills, near Agartala, Tripura State.

S. Deb, Calcutta.

Highly plastic mottled clay of sedimentary origin occurs in the neighbourhood of Agartala, Tripura State. Detailed prospecting work has been carried out in this area by the author and about a dozen trial-pits have been dug to know the extent of deposits. The total approximate reserve of different varieties of clay occurring in Champamura hills is 50,000 tons. In the Baldekhal area adjoining the Champamura hills, the reserve is about one million tons. There are other exposures which require further detailed prospecting. The geology of the area has some similarity with the Tertiary sequence of N.E. Assam. It is probable that the low hill ranges of S.E. Agartala are homotaxial with the Tipam Sandstone Series of Upper Assam.

The clay has been derived undoubtedly from the granitic or gneissic rocks found in the Archaean complex of Shillong and other regions of Assam. It is presumed that in the Miocene period a sheltered arm of a sea used to exist in this area, where sediments of clayey and sandy nature were deposited at the bottom of the basin.

Optical and physical properties of the clay have been determined. Clay minerals of kaolinite-anauxite group have been recognised. The chemical analysis also corraborates the same nature of the clay substance. When burnt, the clay appears to be very refractory in character and turns into a semi-white cream coloured mass at 1250°C. It does not show any sign of fusion at the temperature. By reducing the plasticity, the clay can be moulded into very fine china-ware with slightly stained surface. The installation of a washing plant and a ceramic factory in the neighbourhood of Agartala has been recommended.

16. The Possibility of Utilisation of Carbonaceous Shales for the Manufacture of Portland Cement.

R. Ghosh and P. K. Ghosh, Calcutta

Coals with ash-content over 30% find little use in any industry. They are classified according to their ash-content as shaly coals, carbonaceous shales etc. In coal seams they occur in bands or layers varying in thickness from 2″ and over or even less. During extraction they are separated from good coal and generally stacked in open places adjoining collieries. Due to atmospheric oxidation these hugestacks of waste material catch fire and often becomes a danger to the coal seam itself. Some of the carbonaceous shales burn to a white ash. The clay complex of ash would furnish the requisite material and would serve the purpose of clay required for the cement mixture. Besides supplying the clayey matter these would supplement the heat required for clinkering the cement mixture. The use of these white burning carbonaceous shales for manufacturing white cement would find an outlet for the utilisation of these waste materials.

17. Mineral Resources of the Damodar Valley and Adjacent Region and their utilisation for Industrial development.

V. R. Khedker, Calcutta

The Damodar Valley Project encompasses portions of Bihar, Orissa and Bengal and lies in a region which abounds in rich deposits of economic minerals. This account presents all available statistical data in the possession of the Geological Survey of India, especially the reserves of minerals and the amounts spent by India on imports.

The following minerals, mineral assemblages or rocks which serve as raw materials for industry or have some commercial application occur in the Damodar Valley and adjacent region. Abrasives, apatite, asbestos, barytes, bauxite, chromite, clay, coal, construction materials, copper ore, gold iron ore, mica, mineral fertilisers, mineral springs, ochres, refractory materials, salt, silica, steatite, sulphur and vanadium ore.

The imports into India of capital and consumer goods in the manufacture of which minerals are utilised, amount to about Rs. 700,000,000 annually.

The primary object of this work is to assess the reserves of mineral wealth in terms of development of new and expansion of existing industries.

The pattern of integrated industry utilising minerals as raw materials resolves into two groups : (1) Metallurgical—non-ferrous and ferrous ; (2) Non-metallurgical chemical, heavy chemical, cement, ceramic, refractory, insulation, glass, paints and pigments. Products of both these groups ultimately enter into the production of capital machinery and consumer goods.

This pattern of industry unfolds great potentialities capable of being developed and mobilised with help of research, planning and organisation under a system of exploitation in the best interests of the nation.

18. Refractive Indices of Vitrain as an Index of Rank.

K. C. Lahiri *and* R. N. Basu, Digwadih.

In petrographic studies attempts have been made to measure the degree of coalification based on quantitative optical tests. It has been found by previous workers that the index of reflection is inversely related to volatile-matter content. In this study also refractive indices of polished vitrains from Indian coals have been determined and correlated with the rank of coals. A Reichart horizontal-circle goniometer fitted with suitable accessories and a Leitz polarisation apparatus were used for the determination of the Brewster's angle.

Vitrains from the following seams were examined :—

Namdang (Tertiary coal, Assam), R.I., 1.702 ; Karkata seam (Karanpura) R.I., 1.708 ; Dobrana seam (Ranigan) R..I, 1.709 ; Argada seam (Karanpura) R.I., 1.741 ; No. XVI and No. XIV seam, R.I., 1.760 and R.I., 1.786 respectively ; No. XI seam R.I., 1.817 ; and No. VII seam, R.I., 1.842. The last four from the Jharia field are of special interest. The carbon contents (on pure coal basis) are as follows : No. XVI, 86.60% ; No. XIV, 87.80% ; No. XI, 88.80% ; and No. VII, 89.50%.

It is observed that for the seams of Jharia coalfields a straightline relationship exists between the refractive indices and the carbon contents of vitrain specimens obtained from these seams. These coals are of coking quality. In other words, increase in rank is accompanied by an increase in refractive index. Thus, in the seams of the Jharia field refractive index increases with the depth of coal seams in much the same way as fixed carbon increases (Hilt's Law).

The results, although not extensive enough to justify generalisation, indicate that there is a probable relationship between rank and refractive index of coals from the the same horizon in the same coalfield. Further work on these lines and on refinements in determination of the maximum angle of polarisation is being continued.

19. A Reconsideration of the Economic Aspect of the Chhakkarbandah Tin Deposit, Gaya District, Bihar.

N. K. Mukerjee, Banaras.

Mr. D. C. Nag, the discoverer of the Chhakkarbandah Tin Deposit, has shown in his estimate that the above-mentioned deposit is profitable even when 1% of cassiterite is available from the crude ore. But the present writer, in course of his field-study in the area, has found that mining for cassiterite is carried on by crude country-made inplements for which the production of ore is almost negligible and the cost of production is too high. In an estimate, it has been shown that actually there is a loss in continuing the project even when the most successful trial pit of the area is yielding an ore containing .5% of cassiterite. There are major problems of labour, machinery, power, water and communication together with other minor difficulties in the area. The most important problem is that of machinery, and without proper machinery, the production ot in-ore cannot be raised up. Moreover, the area has not yet been very thoroughly studied from the geological point of view and, therefore, it is not yet possible to ascerain the exact quality and quantity of the ore-deposit of the area. In the opinion of the writer, the tin deposit of Chhakkarbandah should be critically examined first and then if it is found promising, mining with proper machinery should be started.

20. The Source of Manganese in the Manganese Ores of Mysore.

B. P. Radhakrishna, Bangalore.

Detailed mapping of the Chiknayakanhalli schist belt has shown an invariable association of manganese ore bodies in the area with the basal position of limestone beds. Analyses of these limestones especially from the basal portions reveal a richness in manganese, varying from 2.5 to 10.0% of MnO. It is concluded that the manganese ores are formed by the weathering and replacement of the lowermost beds of limestone which are manganiferous and that a distinct stratigraphic horizon containing manganiferous dolomites can be recognised in the schist belt.

21. Mica of Mewar.

R. V. K. Rao and S. K. Goel, Mewar.

Mica of good quality occurs in the Toonka, Chondawas, Amli, Sidriyas and Malola mica mines in Mewar State. Generally the mica is a ruby variety of muscovite, but a green variety and phlogopite are also found.

STRATIGRAPHY.

22. Is the Semri Series in Bundelkhand Bijawar or Lower Vindhyan ?

V. S. Dubey, U. S. Sanwal, and K. C. Joshi, Banaras.

The Semri Series and the other formations of Bundelkhand have been studied and mapped for about 40 miles. Here the Semri Series consists of quartzite, porcellanite, black shale, quartzite with limestone and shales overlaid by thick bed of Kaimur Conglomerate mostly made of jaspers. The thickness varies from 100 feet to zero feet near Panna town. Porcellanite rock of this series are definitely silicified basic tuffs.

The similarity of the Bundelkhand Semri Series with typical Bijawar area two miles away, presence of basic igneous rocks and jasperiodal rocks, great unformity between this Series and overlying upper Vindhyans and absence of jaspers from the Basal Conglomerate tend to show that this Semri Series in Bundelkhand should be better assigned to a part of the Bijawars. In the opinion of the writers Vindhyans in this area being with Kaimur Conglomerate followed by Kaimur Sandstone as is the case near about the typical Gwalior area.

The study of this and the surrounding area shows that this Series containing basic rocks was followed by ultrabasic rocks containing diamonds. The igneous cycle ended by intrusion of granites, acid-dykes and possibly by flows of rhyolites at the end of Bijawar period and in pre-Vindhyan times.

23. On Buried Gondwanas near Jubbulpore, C.P.

K. K. Dutta and A. K. Roy, Calcutta

The paper deals with an inlier of Gondwanas struck while boring for water in Marotal village (79° 54′30″ : 23° 12′), about one and a half miles northwest of Jubblepore, C.P. The area round Marotal village consists of alluvium, which hitherto was believed to be lying over granites and granite gneisses. But the boring proves that this is not so. Inliers of Gondwanas also do occur buried underneath the alluvium. The strata chart of the above shows that the alluvium here is about 60 feet thick, succeeded in descending order by about 10 feet of laterite, 38 feet of white clay and the rest down to a depth of 145 feet medium to coarse grained friable Jabalpur sandstone. The rocks have been described and their relation established with the Jabalpure grits ccourring in the Jubblepore Cantt.—the type area.

24. A Note on the Inter-Trappean bed at Doddihal, Bijapur District.

K. V. Kelkar and Y. S. Sahasrabuddhe, Poona.

The note describes the inter-trappean bed at Doddihal (16°24′; 75°33′), which is one of the three known fossiliferous inter-trappean beds in the Southern Mahratta in Belgaum District.

The Doddihal inter-trappean rock is a calcareous sandstone consisting chiefly of quartz, fragments of fossil shells and calcite, and a small amount of feslpar, chily-microcline. The accessories in the rock are : ilmenite, haematite, zircon, tourmiline garnet, epidote, hornblende, more or less chloritised biotite, and a few grains of apatite rutile, sphene, kyanite and staurolite. The fossils are : shells of Bullinus (Physa) prinsepii and a few of a Lymnaea closely resembling Lymenaea attenuata of Hislop.

The Upparhatti and Mamdapur beds also consist of calcareous sands made up of quartz, shell fragments and calcite, and a few grains of microcline and turbid felspar, and contain iron ores, garnet, epidote, tourmaline, zircon, hornblende, actinolite, kyanite, staurolite, rutile and apatite as accessories. The accessories are almost identical with those occurring in the Doddihal bed. The fossils in these beds include a few shells of Bullinus (Physa) prinsepii of a species of Indonaia, and of a variety of Potomida favidens ; and some shells of Lymnaea closely resembling those in the Doddihal bed There are also present a number of shells of Ena (Subzebrinus) sindica (Reeve).

25. The Correlation of the Gondwanas (?) of the Guntur District by Sedimentary Petrographic Methods.

M. Poornachandra Rao, Waltair.

On the coastal region of some of the Circar Districts of Madras Presidency outliers of sheets and patches of sandstones and shales outcrop in several localities, some out of which are fossiliferous but most of them are devoid of any recognisable organic remains. Some of these are in the Ongole area, others in the Guntur area and yet others near Rajahmundry and environs. The sandstones of the Rajahmundry area in Godavari District are surmised to be homotaxial with the Cuddalore sandstones and thus relegated to Tertiary age. The sandstones and shales near Ongole were relegated to the Upper Gondwana Series from fossil evidence. In the intervening area, the patches and spreads of sandstones (and occasionally shales) which are devoid of fossils, present difficulties with regard to their correlation and were thought by Bruce Foote to be homotaxial with the Upper Gondwanas. This paper is an attempt to tackle the problem by methods of sedimentary petrography. From a careful study of the results it is established that the doubtful rocks in the Guntur area show greater affinity to the Tertiary formations of Rajahmundry area and great divergence from the upper Gondwana formations of the Ongole group of rocks,

26. A Study of the sedimentary Formations of the Coastal Region of East Godavari District.

S. Sriramadas, Waltair.

A reconnaissance survey has been made in the coastal region of East Godavari District and in parts of Vizagapatam District. Outlies of sandstones are noticed in several localities. The disposition of these formations is a matter of uncertainty as they are mostly covered with soil and exposed here and there in quarries for road metal. Some are highly ferrugineous indurated fine grained red sandstones. Others are coarse to conglomeratic in nature and some buff to white coloured and are argillaceous. In one locality the sandstones are highly fossiliferous though the fossils are badly preserved.

The paper records the preliminary results of the study of these rocks by sedimentary petrographic methods with a view to assign them to their proper stratigraphic horizon.

27. Geology of Karempudi and Durgi Areas Guntur District.

G. V. Umamaheswara Rao and K. Kondaiah, Waltair.

The study of the stratigraphic position of the Palnad formations in parts of Guntur district has been taken up for the last three years in the Andhra University. In the previous communications on this subject by previous workers of the Geology Department evidence was adduced to suggest an angular unconformity between the uppermost Cuddapah beds and the Palnads, the latter being surmised to be homotaxial with the Kurnools. The authors of this paper working in the Karempudi and Dugri areas have mapped in detail the members of the Purana group which cover the whole of this area (G.T. Sheet 56P/11). A detailed study brings out the following important facts;

(1) The repetition of some of the beds in the Cuddapah formation are shown to be due to an overfold and some of the anomalous observations noted by the previous workers from the department are easily understood in the light of this evidence.

(2) The analytical data about the nature of the limestones in the area confirm the inference of an uncondormity.

(3) The Palnad Series in this area is shown to consist of a basal conglomerate grading into sandstones, shales and finally to limestones.

These limestones have the greatest resemblance to the Nerjee limestones of the Kurnool group. These observations take us a step further in the elucidation of the statigraphy of the Palnads.

28. Geology of the Area between Law, Lemalle, and Nirukonda Hills, Guntur District.

Rama Krishna Rao, Banaras.

(Communicated by D. K. Chakravarti)

The geological formation of the area were studied in detail both in the field and in the laboratory. The physiographic features are described elaborately. Much of the area is covered by Black Cotton soil. The rock formations crop out mainly along side the road, Guntur-Amaravathi. The rock types recorded in order of abundances are : 1. Granites, 2. Charnockites, 3. Leptynites, 4. Pegmatites and Quartz vein 5. Quartzites and Spotted-Slates. Migmatites and other hybrids also were noted. Ultrabasic, basic and intermediate types of Charnockites occur, of which the basic type is predominent, while acidic type is absent. The Granites show evidence of assimilation of the pre-existing Charnockites and the granitic intrusion is responsible for the production of various hybrids and migmatites. It is suggested that the basic Charnockites were originally of igneous origin, while the ultrabasic types were produced by the excessive development of Hornblende as a result of the interaction between Hypersthene and Plagioclase, a metamorphic reaction. (Photo-Micrograph) The intermediate types seem to have evolved as a result of marginal granitisation of the basic Charnockites. The Leptynites are surmised to be the reconstituted Khondalites affected by the intrusion of basic Charnockites. Economically, the area is not of much importance except for building stone and road metal.

PALAEONTOLOGY

29. Microfossils from the Cambrian Strata of the Salt Range, Punjab.

A. K. Ghosh and A. Bose, Calcutta.

Gee suggested that the micropalaeontoligical examination of control rock samples from the Cambrian strata of the Salt Range of the Punjab may be helpful in explaining the wide occurrence of Tertiary microfossils in the infra-Cambrian Saline Series. A preliminary report on the examination of control samples of undisputed age was communicated by the authors in a previous session of this section. Since then a number of such samples, collected by the B.O.C. (I.C.) Ltd., are being examined by the authors and the following micro-fossils in addition to the previous findings are listed. Samples called ' Black" are from 1 ft. inside the rock surface, those called "Red" from the surface.

(1) *Purple Sandstone*—Sample No. 6, Black and Red, Sandstones, from Warcha gorge, yielded carbonised and non-carbonised pieces of wood showing uni-multiseriate simple pits, scalariform and bordered pitted tracheids ; cuticles, a few Sports, and insect remains.

(2) *Neobolus shales*—Sample No. 7, Black and Red, fine grained greenish sandstone from the locality of No. 6 and Sample No. 8 Black calcareous sandstones, from Chittidil, yielded carbonised pieces of wood showing uni-multiseriate simple pits, pit relics, non-carbonised woods with or without pits ; and a few spores.

(3) *Magnesian sandstone*—Sample No. 9, Black, light grey micaceous sandstone from the locality of No. 8 yielded carbonised bordered pitted and scalariform tracheids, single pitted pieces of wood, and non-carbonised wood elements with simple or bordered pits, or without pits ; and cuticles with stomata.

(4) *Salt Pseudomorph Beds*—Sample No. 10, Black and Red, sandy shale (not a typical sample) from the locality of No. 8, yielded structureless pieces of carbonised woods, scalariform and simple pitted tracheids ; a few cellular structures, membranes, etc.

The occurrence of vascular plants in the Cambrian beds is not in conformity with the known fossil records, and yet remains to be explained by further extensive investigation which is in progress.

30. The Stratigraphical Value of Miscellanea and Pellatispira in Pakistan, India, and Burma.

Y. Nagappa, Digboi.

In the Eocene of Pakistan, India and Burma, two genera-*Miscellanea* and *Pellatispira*—have shown a remarkably stable and limited vertical range in the several areas in which representatives of these genera are found. *Miscellanea,* which is represented by *M. miscella, M. stampi,* and *M. meandrina,* is confined to the Upper Ranikot (*Palaeocene* age) in all the areas examined so far, while *Pellatispira,* which is represented by *P. orbitoidea, P. infata, P. madaraszi var indica* and another species which may be new, is found only in the very high Eocene (Upper Eocene—mostly Bartonian) beds. Because of their very restricted vertical range these two genera have a considerable stratigraphic value.

31. More Dasycladaceae from the Niniyur Group (Danian) of the Trichinopoly Cretaceous, S. India.

L. Rama Rao, Bangalore.

In the Memoir on the "Fossil algae from the uppermost Cretaceous beds (the Nimiyur group) of the Trichinopoly District, S. India" (L. Rama Rao & Julius Pia : Pal. Indica N.S. Vol. XXI, No. 4, 1946) an account was given of the *Dasycladaceae* occurring in the Niniuur group ; and practically all these were found in the chert bands near Nattagooly. A further collection has since been made of similar cherts from other parts of the area, and sections of these reveal an extraordinarily rich abundance and variety of *Dasycladpceae,* including several new forms not described in the 1939 memoir. The entire material is exceedingly well preserved.

32. Note on a Fossil Find from the Inter-trappeans of Dongri, Salsette Island Bombay.

R. N. Sukheswala and D. N. Elchidana.

This paper is written to put on record the occurrence of a fossil fish in the Inter-trappeans of Dongri, s small village situated in the north-western part of the Island of Salsette, Bombay.

This part of the Island consists of hill masses ranging to a height of about 309 feet. The dominant rock types constituting these hill masses are the rhyolites together with minor associations of ash-sedimentaries (Inter-trappeans), massive ash, and trachytes.

The bed which has yielded three specimens of fossil fish together with impressions of scales is formed of ash material of volcanic origin. The bed is hardly 4 feet thick and very limited in extent. The fossil specimens as identified by Hora reveals the following characters :

The fossil fish belongs to the sub-order Percoidei in which the fins are provided with spines and the ventral fins are thoracic. It is likely that they belong to the family Apogonidae which in its distribution is from Eocene to Recent. Fossil scales are identified to be of the Ctenoid type which also show that the fish may have been of the sub-order Percoidei.

Chemical analyses of rhyolites and trachytes are added and field relations and laboratory data help us to establish some sort of genetic relationship between the various rock types existing in the area.

MISCELLANEOUS

33. Studies in Pleistocene Glaciation in the Eastern Himalayas—I.

N. R. Kar, Calcutta.

The paper embodies the results of investigations arising out of field work on glaciologic lines carried on a part of Eastern Himalayas which have led to the recognition of a Pleistocene glaciation on a gigantic scale attended with all the sedimentologic features of an Ice-Age. Evidence along geomorphic, petrographic, glacio-fluvial lines has been adduced which proves beyond doubt an advance of a huge glacial lobe encroaching from over Central Himalayas down to an altitude of 500 feet in the North Bengal Plain. Occurrence of huge erratic boulders, unassorted 'till-fabric', morainic topography, drumlin formations, terminal moraines, glacial pool and the likes have been indicated. Shape and form analyses of several hundred drift boulders selected at random have yielded interesting results confirming the earlier findings of Von Engeln (1930) and Wentworth (1936). Evidences of several glacial periods separated by 2 to 3 inter-glacial phases have been put forward from the study of weathering differentiations and englacial and sub-glacial stream-terraces.

34. Spontaneous Polarisation Survey of the Kunchiganhal Block of the Sulphide Zone of Chitaldrug, Mysore.

A. S. Narasimham, Madras.

Geophysical principles are important in economic geology and date obtained from geo-physical survey of a mineral ised region are far more reliable and precise than two decades, ago. Geo-physical science has advanced so vastly that it has become a necessary help to economise on the initial cost of prospecting operations based upon surface geological mapping alone.

As an instance, spontaneous polarisation data obtained in a block of the sulphide zone of Chitaldrug (Mysore), known as the Kunchiganhal block are presented in graphs of s. p. (spontaneous polarisation) curves and e. p. equi-potential) contours, the latter being embodied on the geological plan of the block. Two centres of maximum potentials are indicated, where at prospecting operations are expected to yield favourable results. The depth of the orebody and their shape is also calculated from the survey data. The interpretation of the s.p.e.p. lines with reference to this particular field is also attempted.

GEOGRAPHY

35. Mohanpur Hana : A Spill Channel of the Damodar.

S. C. Bose, Calcutta.

Mohanpur Hana is a wayward spill channel of the Damodar, running south of it, 12 miles below Burdwan. After 1943 it became very destructive, and destroyed thousands of acres of arable land. It washed away villages, inundated cultivated fields spread sand over paddy land and created havoc unchecked and unbridled. A hydrological study of the area was carried out, and the construction of a cross-bund suggested, the work being completed in May 1948. It has proved to be a success. A sum of Rs. 1 lakh was spent. It yielded crop worth Rs. 13,50,000 in 1948. A crop worth Rs. 22,25,000 was expected in 1949. The experiment having proved successful, it is suggested that similar bunds be constructed across the mouths of other spill channels in this area.

36. Topographic Changes in the Littoral Tracts of Midnapore, West Bengal.

Monoranjan Chaudhuri, Calcutta.

The Littoral Tracts of Midnapore present interesting physiographic features. The whole area is covered with sand dunes. As one approaches Contai, one comes across a sandy ridge, known as the Contai ridge, which runs from near Contai and continues through Orissa. Another Sandy Ridge runs parallel to the Sea Coast near Ramnagar. The wind is the most active agent of erosion modifying the natural landscape of the area. The sand dunes are migrating into the interior and hence are giving rise to agricultural problems. The predominance of quartz elements and absence of minerals in the sand-dunes indicate that the process of erosion is fairly slow. The work of the wind is more prominent than the work of the sea. Planting of defensive vegetation can alone fight the menace of wind erosion and migration of sand-dunes in the area,

37. Regional Delineation in Madras Province.

V. L. S. P. Rao, Calcutta.

The paper embodies some observations on regional delineation in Madras Province. The delineation offered in this paper is based on geographical and statistical methods.

The Madras Province with a total area of 126,166 sq. miles contains 25 districts including the city of Madras and 222 taluks. Each taluk is further sub-divided into smaller units known as firkas, each firka consisting of 20 to 25 villages. The district is too artificial a unit for economic planning, and the village is too small to be of any practical use in generalisation, hence the need for a unit of intermediary size, on the basis of which major regions should be evolved. According to the Indian Council of Agricultural Research, the Madras Province includes three regions-- Rice region, Millet region and Malabar region. The Industrial Planning Committee constituted by the Government of Madras suggested six regions on the basis of the present districts, the boundaries of which, in most cases cut across the geo-economic trends. Both the above regional schemes are uni-regional, and Madras Province is an agro-industrial and forest province, and for successful regional planning, regional schemes must be based on composite regional factors. According to the regional concept, and on the basis of composite planning factors, the Madras Province is tentatively divided into : (1) the southwest coast plantation cum rice zone, (2) the east coast agro-forest zone, (3) a part of the Tinnevally-Mysore agro-industrial complex and (4) a small portion of the central Deccan Plateau where the occupancy pattern is still evolving.

38. Geo-climatic Aspect of the District of Allahabad.

Mohd. Naseer Khan, Allahabad.

Climatic conditions are generally dealt with on regional basis, and very often cover large areas. This paper has been written from the point of view of understanding local climatic conditions of a given small area.

The paper deals with the climatic aspect from the geographical point of view of Allahabad District which is located on about the confluence of the rivers Ganga and Yamuna. The district covers, 2,848 sq. miles and comprises of eight tahseels namely, Chail, Handia, Mahjhanpur, Meja, Phulpur, Sirathu, Soraon and Karchana.

After a bried introduction of climatic factors, temperature conditions, rainfall, and the variability of rainfall are dealt with. Climatic divisions are introcued. Finally the effect of climatic conditions on economic activities are shown.

39. Some Factors in the Development of Pakistan : A Geographical Consideration.

Maneck B. Pithawalla, Karachi.

Pakistan has inherited a number of physical disabilities, which may be classified as (1) *Geological* : the rocks are very young, highly folded in the mountainous regions, and nearly 99% Sedimentaries. As a result they are unstable, lacking in metalliferous ores etc. ; denudation is enormous, and the rivers young and changeable and quickly silted up at their mouths. (2) *Physiographic* : The desert is advancing northwards, waterlogging and Kalar soils are formed with intensive cultivation, growing deltas afford few chances of harbours, and the fluctuation of water resources causes planning difficulties. (3) *Climatic* : The monsoon rains are late, irregular and scanty in West Pakistan and excessive in East Pakistan. (4) *Spacial* : The two Pakistans are some 1000 miles apart, and Eastern Pakistan is merely an enclave. The two chief harbours are 1000 miles distant from each other. (5) *Industrial* : Antique methods are used everywhere, no iron and steel works are possible, and power resources especially coal and petroleum are limited.

To balance the economy of Pakistan requires intensive regional and land utilisation surveys, which needs a large band of geographers. Unfortunately, the science of Geography, so powerfully nation-building and fruitful, is not sufficiently practised or appreciated.

40. Selection of a Site for the New Capital of Sind.

Maneck B. Pithawalla, Karachi.

Sind, having lost its flourishing capital of Karachi to the new Dominion of Pakistan, must needs have another suitable site for its new metropolis in some other part of the province. For this purpose the Government of Sind have appointed a Site Selecting Committee, who, it has been reported, have recommended a spot falling within the triangle of Jungshai, Jhimpir and the Makli hills, suggesting that its climate is good and all the amenities of life will be found there. This proposal has been criticised in this Paper from the point of view of Geography and as the alternative, the old city of Hyderabad has been recommended strongly from the following points of view : (1) Topography, (2) Climate, (3) Water supply, (4) Amenities of life, food etc., (5) Future development, and (6) Stability of settlement. From all these points of view, Hyderabad would make a far better capital than any other site in Sind.

For a capital city to command a whole province, there must be some stimuli from agricultural and industrial life of the people. These will be found in abundance at Hyderabad, which also has a good historical and heroic background, against which it can stand for all times.

So near the new Lower Sind Barrage with such high traditions, situated centrally amidst first-rate arable lands with plenty of water supply, with vast areas for expansion on every side and with inland fishery to take the place of marine fish of Karachi, and also commanding the land, river and air routes of Western Pakistan, Hyderabad must be given the fullest possible consideration to be the capital of New Sind. But the great trouble in our country is that such schemes are made off-hand without any proper regional survey, which only trained geographers can make with efficiency. Sind has lost an ideal and up-to-date capital in Karachi and it is hoped that it acquires a site for its new capital as only the second best in the province.

41. Land Utilisation of Prayag Area.

Mohd. Naseer Khan, Allahabad.

Land utilisation is a branch of field geography. It represents a graphic picture of an area in the manner in which it is being utilised by man. The areas which are theatres of human activities such as cultivated lands, grazing grounds, woodlands and built up areas ; and the areas not in use such as waste lands and culturable waste, are shown on maps with appropriate descriptions. The whole outlook gives a graphic picture of the conditions of the region, on which can profitably be based economic planning and reconstruction work. The Land Utilisation survey is carried on in detail by surveying in smaller units and afterwards combining them into a region of considerable size.

Most of the civilised nations are planning for development of their countries on the basis of Lald Utilisation. The whole of Britain has been surveyed by Prof. Stamp and much has been done in U.S.A. in that direction.

For the purpose of Land Utilisation a small area known as "Prayag Area" on the north-west of Prayag Station has been selected. On the eastern side is limited by railway line running from Prayag Station to Phapamau, on the north, west and south bounded by Ganga Kachar. A number of maps have been prepared to show the data collected.

42. Mixed Farming in the Tarai Region.

F. Ahmed, Calcutta.

Whereas the Tarai Region has recently been recognised as a separate natural region, it has come to prominence in connection with the food drive schemes of the U.P. Government. But the possibilities of mixed farming in the area are being ignored and this might adversely affect even the existing cattle breading industry, which meets the requirements of at least three provinces. The present paper deals with the general conditions in the country, the present state of mixed farming in the Tarai Region and pleads for help to develop the industry in the region.

SECTION OF ZOOLOGY AND ENTOMOLOGY

President :—Dr. B. C. Basu, D.Sc.

CYTOLOGY

1. The Synthesis of Desoxyribose Nucleic acid in the developing Macronucleus of Chilodonella uncinatus Ehrbg.

B. R. Seshachar, Bangalore.

Developing exconjugants of *Chilodonella uncinatus* show that the two nuclear anlagen start about the same size of 1.7 uiudiameter, and while one of them grows to become the macronucleus, the other remains as the definitive micronucleus of the animal. The history of the macronuclear anlage falls into two phases. The first is one of great enlargement culminating in a macronuclear anlage of a colossal size of 17.3 u, in diameter, filling up much of the space in the cell. During this phase of enlargement, the nucleus is very pale and faintly staning. After the maximum size is reached, the anlage shrinks to the size of the adult macronucleus, which is about 6.06 u in diameter, at the same time acquiring the structure characteristic of it. Photometric measurements of the developing macronucleus show that throughout this period of enlargement and diminution, the macronuclear anlage is synthesizing D.N A and while in the first phase two-thirds of its D.N A content is acquired, the other one-third is synthesized in its second phase. The view is held that this D.N.A comes from the old macronucleus which show a progressive degeneration corresponding with the growth of the macronuclear anlagen.

2. Role of the Nucleolar Bodies in the growth of the Egg.

Brahma S. Kaushiva, Lucknow.

This investigation deals with the extensive cytological changes that occur in the oocyte during oogenesis.

In the oocyte two kinds of nucleoli are present : plasmosomes and karyosomes. The plasmosomes are non-chromatinic and give a negative Feulgen reaction. The karyosomes, on the other hand possess chromatin material. Methods were not employed which demonstrate the true chemical nature of the nucleolus. The plasmosome undergoes active changes in form, size and staining capacity during oogenesis. In early oocytes it occurs as a single rounded body within the nucleus. On reaching a certain size it begins to fragment and forms several smaller bodies. These bodies arrange themselves near the nuclear membrane and are eventually extruded into the cytoplasm of the oocyte. Likewise karyosomes are extruded, but less frequently. Follicular nuclei and epithelial cells are also emitted into the ooplasm and thus serve as a second source of chromatin material for the ooplasm.

It is suggested that the extruded plasmosomes provide the agency by which ribonucleic acid from the nucleus is laid down into the egg cytoplasm. This conclusion is supported by the observations of Caspersson and Schultz (1940), Brachet (1940) and Painter (1945). The functional significance of the extruded karyosomes is problematical and no suggestion of their role in the cell metabolism is offered here.

3. Studies on chromosome behaviour. I. (Oedipodinae, Acrididae).

M. K. Dutt, Izatnagar.

A detailed quantitative study of meiosis and chiasma formation have been carried out on *Trilophidia turpis* Wlk., *Oedaleus abruptus* Thunb. and *Acrotylus humbertianus* Sauss. In all the three genera studied, the diploid number of chromosome is $2n=23$ in the male. Measurement of chromosomes at 2nd. division metaphase stage shows that there are a pair of long chromosomes in both *Trilophidia* and *Acrotylus*. The number of the small chromosomes differ in the three genera. The X -chromosome is one of the medium sized ones in all the three. The chiasma frequency for the whole nuclei at diplotene, diakinesis and metaphase is 13·93+0·28, 13·26+0·30 and 12·80+0·36 in *Trilophidia*, 14·72±0·34, 13·80±0·12 and 14·00±0.27 in *Oedaleus* and 15.85±0.80, 14.84±0.32 and 13.88±0·23 in *Acrotylus* respectively. There is a statistically significant reduction of chiasma frequency from diplotene to metaphase in both *Trilophidia* and *Acrotylus*. Significant increase in teminalisation coeflcient has been observed in *Trilophidia* only. The longest bivalent of *Oedaleus* shows in most of the nuclei a very prominent terminal heterochromatic segment. Polyploidy both at spermatogonial metaphase and spermatocytes has been observed in *Oedaleus.*

4. Studies on the Chromosome behaviour and sex chromosome in Chrotogonus sp. (Acrididae, Pyrgomorphinae).

M. K. Dutt, Izatnagar

The chromosome number has been found to be $2n=19$ in the male. There are a pair of long, a pair of small and 7 pairs of medium sized chromosomes. The sex chromosome is longest in the complement. The sex chromosome in this species, unlike that in others Acridids studied so far, never shows negative heteropycnosis in either spermatogonial prophase or at any stage of metaphase. It becomes positively heteropycnotic at the prophase of meiosis and continues to be so right upto diakinesis. Occasionally this chromosome exhibits a slightly lesser staining affinity at Metaphase I. Its negative heteropycnosis starts from late anaphase I. It becomes over condensed at Telophase I, and remains so ever after. Thus the heteropycnotic phenomena in *Chrotogonus* take place only during meiosis. The X -chromosome is reductional in the first meiotic division.

The average chiasma frequency for the whole nuclei at diplotene, diakinesis and metaphase are 11·97±0·28, 11·44±0·25 and 11·44±0·21 respectively. A detailed study of the movement of chiasmata shows that there is no loss of chiasmata in the long bivalents. A slight loss of chiasmata and an appreciable increase in the terminal chiasmata have been observed in the medium sized ones from diplotene to diakinesis. The short bivalents show almost no movement.

5. Spermatogenesis in Crocidura Caerulea (Anderson).

G. W. Vaidya, Nagpur.

The spermatogonium is a small, rounded cell with compact Golgi elements on one side. The mitochondria are dispersed in the cytoplasm near the Golgi mass. The primary spermatocyte contains Golgi elements in the form of distinct granules localised in the resting cell but scattered just prior to division. The mitochondria are in a dispersed state throughout. In the secondary, spermatocyte the Golgi elements aggregate to form a mass near, but not touching the nucleus. In the spermatid this mass is very conspicuous lying on the nuclear wall. This Golgi mass gets transformed into a big, fan shaped acrosome. The nucleus of the spermatid is very small and stains homogeneously by Feulgen reaction. The mature sperm has a very conspicuous, heart-shaped, thin acrosome about ten times bigger than the head which is inserted in its posterior side. There is no post-nuclear cup or insertion notch. The neck region is very much reduced. The middle piece is short and merges in the tail of moderate length.

6. A case of non-division of the sex chromosomes in both meiotic divisions of the bug, Dysdercus koenigii (Fabr.).

S. P. Ray Chaudhuri and G. K. Manna, Calcutta.

The sex chromosomes divide either at the first or second meiotic division and consequently one of these divisions becomes either equational or reductional for the differential segment of the sex chromosome. A curious case of non-division of the X and Y chromosomes at both meiotic divisions has been discovered in *D. koenigii*, a hemipteran belonging to the family Pyrrhocoridae, The diploid number of chromosomes was determined from the spermatogonial metaphase stage and was found to be 16. A study of the meiotic divisions revealed that the species has an XY—mechanism of sex determination. The sex-chromosome pair pass to the opposite poles at anaphase. I. Curiously enough, in the anaphase stage of the second meiotic division either the X or the Y (as the case may be) again travel undivided to one pole of the spindle thus giving rise to sperms, half of which receives a sex chromosome and the other half is without it. The latter kind is probably entirely non functional because examinations of the chromosomes of the testes of a large number of individuals always revealed a constant number of chromosomes. The division of the sex chromosomes is presumably postponed till the first cleavage division of the zygote.

7. X and " Neo-Y" mechanism of sex determination in an Indian Grasshopper.

S. P. Ray Chaudhuri *and* A. Guha, Calcutta.

The spermatogonial metaphase complement of Eupreprocnemissp is 22 with an X and "neo-Y" mechanism of sex determination. This mechanism has evolved from an XO type by a single translocation between a member of one of the longest pair of autosome and the original heterochromatic X chromosome. The reconstructed X, therefore, has a short heterochromatic and a comparatively longer euchromatic segment. During the first meiotic division the homologous member of the autosome pair involved in the translocation acts as a mate to the translocated arms of the X by forming a terminal chiasma and thus in effect becomes a Y chromosome.

The evolution of X and "neo-Y" in the present case, must be of very great antiquity because unlike the translocated segment of the X, the Y has become heteropycnotic by being confirmed in the male line for a long period. The original X and also the Y remains over condensed throughout the prophase of meioisis but the nature of condensation is different in the two cases indicating distinct origins for the two types of heteropycnosis. The short terminal pairing segment of the X also appears to be heteropycnotic like the Y.

8. Effect of X-rays on the meiotic chromosomes of Gesonia punctifrons (Acrididae).

Ira. Bose, Calcutta.

The effect of ionizing radiations on the mitotic chromosomes of animals and plants are well known, although comparatively few attempts have so far been made to study the same in the meiotic chromosomes. An attempt has therefore been made here to study the diverse effects of X-rays on the meiotic chromosomes of the grasshopper *Gesonia punctifrons* in order to understand more precisely the nature and significance of structural changes produced by irradiation.

Four lots of the male grasshoppers were given 40, 120, 280, and 320 r units of X-rays respectively, keeping every other condition constant. The chromosomes were studied at successive hours after irradiation starting from 6 hours and extending upto 72 hours.

The different types of X-ray induced changes obtained in the metaphase stage of the first division may be classified as (i) Gaps or unstained regions in one of the homolouges of a bivalent; (ii) faint-stained regions; (iii) single chromatid breaks; (iv) single-thread connective between the broken pieces; (v) constrictions; and (vi) faintly stained constrictions.

The changes recorded at Anaphase 1 of meiosis are inversion bridges with fragments and fragments alone.

All these types of chromosome changes both at anaphase and metaphase of 1st division of meiosis show a definite increase at the higher dosages; but none of these types exhibit a direct proportionality to the increased desages, either at any particular hour after irradiation or as a total of all hours. The frequency of changes at almost all the dosages is highest in chromosomes examined at 72 hours after treatment. The significance of the above results has been discussed.

9. Chromosome behaviour in fourteen species of Hemiptera.

G. K. Manna, Calcutta.

Meiosis in the males of fourteen species of Hemiptera belonging to three different families have been investigated. All the species belonging to the families Pentatomidae and Lygaedae studied, show XY mechanism ,of sex-determination whereas those belonging to Coreidae show XO type. The sex chromosomes in all the species divide equationally in the first meiotic dividsion and in the second division, the X and the Y pair at metaphase and move to the opposite poles of the spindle. Chromosome counts in the spermatogonial and spermatocyte stages in the various species are shown below :

Name	Spermatogonial count	Primary spermatocyte count	Secondary spermatocyte count
PENTATOMIDAE.			
1. **Coptosoma cribarium** (Fabr.)	12	5,X ,Y	6
2. **Aspongopus obscurus** (Fabr.)	14	6,X ,Y	7
3. **Aspongopus Janus** (Fabr.)	14	6,X ,Y	7
4. **Agonoscelis nubila** (Fabr.)	14	6,X ,Y	7
5. **Halys dentatus** (Fabr.)	14	6,X ,Y	7
6. **Plautia fimbriata** (Fabr.)	14	6,X ,Y	7
7. **Eusarcocoris guttiger** (Thumberg)	14	6,X ,Y	7
LYGAEDAE.			
8. **Lygaeus hospes** (Fabr.)	14	6,X ,Y	7
9. **Lygaeus pandurus** (Scop.)	14	6,X ,Y	7
10. **Graptostethus sevus** (Fabr.)	14	6,X ,Y	7
COREIDAE.			
11. **Leptocorisa acuta** (Thumberg)	17	8X	7
12. **Serinetha augur** (Fabr.)	13	6X	7
13. **Cletus bipunctatus** (Fabr.)	17	8X	9
14. **Cletomorpha hastata** (Fabr.)	21	10X	11

10. Multiple sex-chromosome mechanism in a Reduvid bug, Conorhinus rubrofasciatus (de geer).

G. K. Manna, Calcutta.

A number of cases of multiple ses-determining mechanism in the Hemiptera have been reported from the family Reduvidae. Among the several species of male Reduvid bugs examined by the present author *Conorhinus rubrofasciatus* shows $X_1 X_2 : Y$ type of sex determination. The sex chromosomes divide equationally at the first meiotic division and form a group of three at the second meiotic metaphase of which the two smaller elements presumably the two X_1X_2 pass to one pole and the large one or the Y to another pole. The chromosome number determined from the spermatogonial metaphase stage is 25,

11. Distribution of Glycogen and Iron in the Placenta of Crocidura caerulea (Anderson).

N. Owers, Nagpur.

It is only recently that studies have been undertaken to investigate the cytochemistry of the gravid uterus. During the development of the embryo various structures, e.g., uterine glands, uterine epithelium, yolksac, chorioallantoic placenta, become successively important as media for physiological exchange between mother and foetus. The author has studied the distribution of glycogen and iron in the uterus of *Crocidura caerulea* (Insectivora) during different stages of gestation. This animal was chosen for study because its embryology is well known. (Sansom, 1937). The author also discusses the techniques used for micro-chemical tests.

12. Alkaline phosphatase in the uropygial gland of normal and of androgen treated pigeons.

Amiya B. Kar, Calcutta.

Alkaline phosphatase is present in diffuse quantities in the uropygial gland of the pigeon. Androgenic treatments depress the activity of the enzyme in the gland but do not abolish it. It is suggested that the holocrine lipoidal cycle in this gland is mediated by the phosphatase through the influence of sex hormones. The possible role of the phosphatases in the mechanism of action of hormones is discussed.

EMBRYOLOGY

13. Stages in the Development of Tornaria Krohnii from Madras.

K. Pampapathi Rao, Madras.

Ramunni Menon recorded this larva in 1903 and Stiasny-Wijuhoff and Stiasny classified it as Tornaria Krohnii and attributed it to Glossobalanus.

Material was obtained from the plankton. The larvae were reared in finger-bowls for nearly a month. Three important stages, covering the development upto the metamorphosis were described—namely, the Muller stage, the Krohn stage and the metamorphosed larva.

The Muller stage is the youngest and smallest. The apical plate, apical tuft and the apical string are present. The longitudinal bands are very simple. The telotroch is absent. The alimentary tract is well developed, and the proboscis coelom is formed.

The Krohn stage represents the highest development of the free-swimming larva. All the ciliated bands are well formed. The coelomic pouches are all formed. The larva swims freely at the surface.

The metamorphosis takes place after the larva took to the bottom and decreased greatly in size. The youngest metamorphosed form has a well-defined proboscis with the central complex just pushing forward. The collar is also differentiated though not quite clear. The telotroch, the apical tuft and the eyespots still persist. The larva is more opaque and begins burrowing.

Thus there is a progressive, a regressive and a metamorphosis period in the growth of the Tornaria of Madras as noted by Stiasny in other forms.

14. On the development of the vertebral column in Rana tigrina, and its position in the phylogenetic history of the centrum of Salientia.

H. K. Mukherjee *and* J. N. Rudra, Calcutta.

The formation of the centrum from the perichordal tube has been clearly shown by Mukherjee and his collaborators, in several species of Salientia. It has been shown that the centrum develops from the perichordal tube, or part of it and from the arch bases, as stated by previous investigators. The presence of a median ventral cartilaginous *hypochord* in different regions of the vertebral column has been described by some workers in some Salientia. Mukherjee and his co-workers have shown that the mid-ventral hyaline cartilaginous structure is a part of the perichordal tube and may be present in varying extent in different groups of Salientia.

The present paper deals with the development of the vertebral column in *Rana tigrina*—the common bull frog of India. The notochord shows a moniliform appearance in the present case, which has also been observed in other specimens of Salientia so for examined. This moniliformity appears to be a typical feature of the notochord in Salientia, The ventral hyline hypochordal element is present only in the region of the urostyle and a little in front of it. This presents an intermediate condition between *R. Temporaria and B. melanostictus,* where the hypochordal element is totally absent, and *R. afghana,* where it is present from the third vertebra to the tip of the urostyle. A probable explanation, by way of suggestion, has been given about the function of this hypochordal element. A short review of the different opinions about the mode of formation of the centrum in Salientia has also been given.

15. Embryology of Cynopterus sphinx gangeticus.

M. A. Moghe, Nagpur.

Except for a very fragmentary account of the embryology of *Cynopterus marginatus* by Keibel (1922), very little is known of the embryology of this megachiroptera. The author has examined a very complete series of gravid uteri and specimens at parturition.

Fertilisation occurs in October. All specimens collected on any one day do not show the same stage of pregnancy. It is probable that amniogenesis takes place by cavitation and by folding. The plecenta is labyrinthine, discoidal, mesometrial and hemochorial. The general features of the foetal membrances in this animal are discussed and compared with *Pteropus* and the microchiroptera. Parturition occurs in January. It is possible that there is more than one breeding season though not for the same individual.

16. Placentation in Lyroderma lyra lyra (Geoffroy)—Megadermatidae.

A. Gopalakrishna, Nagpur.

No work has so far been done on the foetal membranes of any member of the family Megadermatidae. *Lyroderma lyra lyra* is a common species of insectivorous bats found in India. The present paper embodies the description of a late stage of development. The arrangement of the foetal membranes in this species resembles that of most other species of insectivorous bats so far studied. The chorioallantoic placenta is discoidal, antimesometrial and haemochorial. The uterus is bicornuate, but only one horn bears pregnancy. At the present state of knowledge of the embryology of this family it is not possible to comment on the statements of Wood Jones (1917) and Harrison Matthews (1937 & 1942) if the left part of the genitalia degenerates in this species also as happens in many species of microchiroptera.

17. On the Origin and Fate of the Pallial Layer in the Oocytes of Marine Teleosts.

H. S. Chaudhry, Allahabad.

In this paper attempt is made to elucidate the complete history of an interesting cytological structure—the pallial layer—in the ooplasm of some marine Teleostean fishes. This structure though reported by Scharff (1887), Calderwood (1892), Franz (1909) and Dragoiu (1922) in the piscine eggs, but very vague and conflicting accounts are given regarding its origin and fate. Whereas, there are some workers like Wheeler (1924) who regard it as a mere artefact.

It has been clearly shown in this paper that the pallial layer is not an artefact but a definite cytoplasmic structure, at least in some fishes. It is present as a deeply stained granular zone round the nucleus and is formed from the archoplasmic material differenciated by the yolk-nucleus of Balbiani. From the perinuclear position it travels as a complete ring towards the egg periphery, where it gets disintegrated and finally lost in the cytoplasm. The fatty and the proteid yolk spherules are formed by the direct transformation of the Golgi and the mitochondrial granules respectively in the pallial substance. The pallial substance does not show any direct relationship either with the chromatin material of the nucleus or the yolk spherules.

18. The Development of the Trunk Vertebra in *Ptyas mucosus* (Linn.)

Maheshwar Singh Sood, Agra.

The author has studied several stages of the development of the trunk vertebra in *Ptyas mucosus* (Linn.) in serial sections. The absence of the supradorsal, the composition of the cartilaginous vertebra out of only three kinds of elements (perichordal tube, basidorsals and the cartilaginous ribs) and the absence of connective-tissue arches are amongst the more important features discovered. The formation of the post-and pre-zygapophyses has been investigated.

19. On the Development of the Freshwater Grey Mulle *Mugil Corsula* (Hamilton)

B. Pakrasi *and* K. H. Alikunhi.

Very little is known about the breeding habits and development of mullets. The accounts of Raffaele (1888), Sanzo (1930) Wimpenny and Fouzi (1936), etc., have not materially helped in giving any specific description of the mullet egg and its nature. The embryonic, larval and post-larval development of the freshwater grey mullet, *Mugil corsula* (Hamilton), have been worked out from eggs and larvae collected from nature by the present authors.

The fertilised egg is demersal, spherical, 0·96 mm. in diameter and with a very narrow vitelline space. A conspicuous oil globule, more than half the diameter of the egg, is the most characteristic feature of the egg. The period of incubation is about 15 to 18 hours. The hatchling, about 3 mm. long, has large transparent eye, a yolk-sac with a large oil globule and several chromatophores on the body. The anal opening is indicated relatively anteriorly, unlike in carp hatchlings.

The mouth and pectoral fin rudiments are indicated in the larva when 40 hours old. With the gradual absorption of yolk the oil globule assumes an anterior position. The eyes get pigmented when the larva is about 3·5 mm. long. The yolk sac is almost completely absorbed in the larva 4.7 mm. long; the anus is situated against the 10th. or 11th. myotome and is in the anterior half of the body. A large stellate chromatophore appears medially at the nape (4.68 mm. larva), where a concentration of chromatophores later results in a specific pattern; several chromatophores appear along the mid-ventral line, against the level of the anal fin, along the lateral line and mid-dorsally, and these, to the naked eye, appear later as dark patches in fresh specimens and are characteristic of the larvae as they swim about. The tip of the notochord is straight but get upturned when the larva is about 4.7 mm. long. The second dorsal and anal fins are differentiated early (5.9 mm. larva). The first dorsal gets well marked out only later when the larva is about 6.5 mm. long. The caudal then appears truncate; and distinct rays are found in the second dorsal and anal. When the larva is 7.65 to 8.0 mm. long, rays appear in the first dorsal and the ventrals. At the 9.63 mm. stage all the fins are found to have their adult complement of rays. The final post-larva stage is about 18.5 mm. long and in that the characteristic straight dorsal profile and the raised eyes of the adult begin to be indicated.

GENETICS

20. Hereditary congenital Flexed Fetlocks in Indian Cattle.

S. V. Chandiramani, *and* P. Bhattacharya, Izatnagar.

Two calves were born with a defective condition of the fetlock joints in the Hariana herd at the Indian Veterinary Research Institute, Izatnagar, and one in the Gir herd of the Indian Dairy Research Institute, Bangalore. The defect was manifested by a sharp and complete flexture at the distal end of the metacarpal bones. The dewclaws were presented in the normal manner, yet sufficiently yielding in position to permit the first phalanx flex right back, making an angle of about 90° with the back line of the metacarpal bone. The abnormal condition was expressed in both the legs. The defect acted as a sublethal, all the calves dying within 40 days from birth. Study of the pedigree records of the affected animals suggested the autosomal recessive nature of the character.

PROTOZOA

21. Encrusting Foraminifera of Krusadai Island.

Cyril Daniel, Madras.

Though *Encrusting foraminifera* have been described before, their occurrence in Indian waters is recorded for the first time. Six species of these, *Planorbulina larvata*, *Gypsina rubra*, *Gypsina plana*, *Gypsina vesicularis*, *Acervulina inharens* and *Homotrema rubrum* are briefly described with notes on their ecology and taxonomic position. The importance of the *Encrusting foraminifera* in the building of coral rocks is discussed.

22. On a Species of Babesia in an Indian Wild Cat.

S. V. Mudaliar, G. R. Achary *and* V. S. Alwar, Madras.

A case of Babesia infection in a wild cat was recorded by the authors for the first time in Madras in 1946. An opportunity was taken to study the organisms, as records of Piroplasmosis in cats are extremely few.

The infection was not heavy and the animal was not showing any symptoms of Babesiosis. The parasites were mostly pear-shaped and a few amoeboid, oval, rounded and band forms were seen, measuring 0·5 u. to 2·5*u* Two, four and eight parasites as in *B. canis* were seen in the erythrocytes. Neither cross-forms nor evidences of multiplication in a cruciform manner were noticed. Blood inoculation into a domestic kitten failed to produce the infection. A few ticks of *Haemophysalis sp.* were found on the body of the wild cat.

The organisms closely resemble those described by Mangrulkar (1937) the only difference being that he did not record the occurance of eight parasites in a single cell and differs from the description of others, particularly in the absence of cross-forms. Since the morphological characters bear a close resemblance to the genus Babesia and as it is considered as a new species the authors propose to give a new name for this species.

23. Fowl Malaria.

S. B. V. Rao, J. Das *and* D. R. Ramnani, Izatnagar.

Occurrence of natural cases of *Plasmodium gallinaceum* in exotic fowls has been recorded for the first time in this country at Izatnagar Poultry Farm.

24. Myxosporidian Parasites of Indian Carps, Catla Catla (Ham) Labeo Rohita (Ham), Cirrhina Mrigala (Ham), Labeo Bata (Ham), and its Seasonal Variation.

S. P. Basu, Calcutta.

A study of the occurrance of external myxosperidian parasites in the Indian carps were carried out.

318 *Catla catla,* (16-51 cm.), 320 *Labeo rohita* (14.5-35 cm.), 339 *Cirrhina mrigala* (14-34 cm.) and 66 *Labeo bata* (18-25 cm.) were examined from July 1947 to June 1948 in a number of fisheries for external myxoporidian parasites and its seasonal variation in the attack was noted.

Summer—*Catla catla*—nil, *Labeo rohita*—70%, *Cirrhina mrigala*—40% and *Labeo bata* —Nil.

Monsoon—All the fish free from infection.

Winter—*Catla catla*—80%, *Labeo rohita*—nil, *Cirrhina mrigala*—20% and *Labeo bata* —nil.

The parasites examined are *Thellohenellus rohitae* (Southwell and Prashad), *Myxobolous catlae* (Chakravarty), *Thellohenellus catlae* (Chakravarty and Basu), *Myxobolous bengalensis* (Chakravarty and Basu) *Myxobolus mrigalae* (Chakravarty).

Chemical examination, temperature and plankton contents of waters carried out to correlate the occurrence of parasite. The results indicate that occurrance of parasite in waters having 400 p.p.m. of chloride content is negligible and below this there is occurrance of the parasite. Mortality of the fishes due to parasitism is rare except in high infection. Infected fishes become sickly and loss in weight as compared to the normal one. It is possible that presence of cysts in the gill filaments hamper with respiratory metabolism of the fish.

HELMINTHOLOGY

25. A unique digenetic trematode referable to a new family.

H. D. Srivastava, Izatnagar.

In digenetic trematodes the acetabulum when present is situated either at or near the posterior end of the body as in amphistomes or it lies in front of it. Where the acetabulum is situated markedly in front of the hinder end, and such forms are by far the more common, some organs connected with reproduction such as gonads, vitellaria, uterus or organs associated with fertilization, invariably lie wholly or partially in the post-acetabular part of the body. In the course of his investigations on the trematodes of Indian food-fishes, the author discovered a form parasitic in a marine host at Karachi which is remarkably different from all known trematodes. The most remarkable feature of this fluke is that though the acetabulum is situated close behind the middle of the body length all organs connected with reproduction lie in front of it. The presence of long tubular and intricately coiled vitellaria and the opening of the intestinal caeca into the sides of the excretory bladder are also rather unusual characters, though present in some phylogenetically unrelated trematodes. In several important features this trematode differs so remarkably from the hitherto known forms that it is necessary to creat a new family for it with the following diagnosis :—

Medium sized, 10 × 4.5 mm., muscular distomes with smooth cuticle and well developed suckers, the acetabulum larger than oral sucker and situated close behind the middle of body length ; alimentary system well developed, pharynx prominent, prepharynx and oesophagus inconspicuous, intestinal caeca extending to the hinder end and opening through narrow tubes into the sides of the excretory bladder ; reproductive organs are all situated in the preacetabular part of body, the genital pore at the base of the pharynx, testes—two situated a short distance behind the intestinal bifurcation one on each side of the median line, ovary situated close in front of the acetabulum to one side of median line, vitellaria in several long irregularly coiled tubes extending from a little behind the genital pore to the anterior level of acetabulum, uterus well developed, preacetabular irregularly coiled containing numerous eggs. Excretory pore subterminal at hinder end of body. Parasitic in the gut of fishes.

26. Two new trematodes from Indian tortoises.

H. D. Srivastava *and* S. B. Manshani, Izatnagar.

In this paper are described one species each of the genera Styphlodora Looss, 1899, and Kaurma Chatterji, 1936, parasitic in the intestine of tortoises at Bareilly. The former genus belongs to the family Plagiorchiidae Luhe, 1901, and is represented by sixteen closely related species occuring in markedly different habitats in various species of reptilian hosts, in widely separated areas of the world. In its systematic position the new parasite stands nearest to *S. compactum* but differs from it in the shape and size of body, position of the acetabulum and gonads, shape, size and position of the cirrus sac and the presence of a long oesophagus, besides the habitat and species of hosts. The genus Kaurma is parasitic in the intestine of Chelonians. The type species—*K. longicirra* was described from Rangoon in 1936 and assigned to the family Allocreadiidae. subsequently, a second species—*K. orientalis*—was described from Japan. The Indian species differs from both these species principally in the size of the body and the position of the cirrus sac.

27. Two new trematodes parasitic in Indian marine food-fishes.

H. D. Srivastava, Izatnagar.

The paper deals with the morphology and systematic positions of two trematodes, one referable to a new genus of the family Allocreadiidae Stossich, 1904, and the other to a new pecies of the genus Pleorchis, family Pleorchiidae Poche, 1925. The alloreadid fluke is ovoid in shape and is very small. The body is devoid of spines but cuticular gland cells are well developed. Oral sucker is slightly smaller than the acetabulum which is situated about the middle of the body length. The oesophagus is absent, pharynx is present and the intestinal caeca extend upto the posterior end. The testes consist of a large number of small follicles aggregated together mostly in the intercaecal space at the posterior end. The cirrus sac contains vesicula seminalis interna, pars prostatica, ductus ejaculatorius and a cirrus ; the vesicula seminalis externa extends upto the anterior reaches of the testes. Ovary is spherical and pretesticular. Uterus is confined to the space between the acetabulum and testes. Genital pore is situated at the level of the middle of the acetabulum, halfway between it and the left body wall. Vitellaria comprises of small follicles extending along the intestinal caeca from the level of the intestinal bifurcation to posterior end where they are contiguous. The characteristic features of the genus are the follicular testes and the position of cirrus sac and genital pore. The species of Pleorchis described has been compared with the three previously known species and a key to the species is given.

28. Studies on some new Diplostome Trematodes of the sub-sub-family *Crassiphialini* Dubois, 1936.

P. N. Chatterji, Cuttack.

Large number of Diplostome parasites were collected from the small intestine of King-fisher *Halcyon smyrnensis fusca.* Most of these trematodes on examination revealed to be of *Crassiphiala* species while some on closer examination were found to be species of *Uvilifer* Yamaguti, 1934 and *Allodiplostomum* Yamaguti, 1935.

Of the two new species described in this paper one comes under the genus Uvilifer Yamaguti, 1934 and another under the genus *Allodiplostomum* Yamaguti, 1935.

A short history of the genera *Uvilifer* Yamaguti, 1934 and *Allodiplostomum* Yamaguti, 1935 and their systematic relation with the genus *Crassiphiala* Van Haitsma, 1925 is given in this paper.

A Key to the genera of the sub-sub-family *Crassiphialini* Dubois, 1936 is also given in this paper.

29. *Vesperugidendrium indicum* (Trematoda) from a microchiroptera.

P. G. Deo, Izatnagar.

A single specimen of the species *Vesperugidendrium indicum,* Pande (1937) was collected from a microchiropteran bat. A detailed study of the stained specimen revealed the undermentioned differences from the form described by Pande.

(1) The oesophagus is short and straight, and not long and curved on one side.

2. The testes are in horizontal plane in the specimen described here while they are diagonal in the specimen collected by Pande.

As only a single specimen was available both to Pande (1937) and the author (1948), it is desirable to refer them to the same species despite some differences in their descriptions and to amend the diagnosis of the genus.

30. On the occurrence of the fluke Clinostomum (Leidy) in the feather-back Notopterus notopterus (Pallas).

P. I. Chacko *and* M. J. Mathews, Madras.

Clinostomum (Leidy, 1856) which occurs in the buccal cavity, pharynx and oesophagus of aquatic birds like heron, bittern, cormorant, and herring-gull, was recorded by us in two specimens of the fish *Notopterus notopterus* captured from the Tunga bhadra project area. The parasites were immature and were found imbedded in small swellings, about 1 cm. in diameter, over the body of the fish, particularly at the base of the fins. The bionomics of the host is briefly recounted.

31. On a Morphological study of the genital organs in certain members of the family Hymenolepididae Fuhrmann 1907.

L. N. Johri, Delhi.

Various genera under the family *Hymenolepididae* are well known for the constancy in the number of the testes contained in each proglottis of a strobila. Interesting variations in the number and positions of the testes are observed in relation to the female genital organs. Further increase in the number of testes is also met with. Testes also how decrease in their number to their atrophy resulting in their final disappearance. Two tables are incorporated to show the arrangement of the genital organs clearly indicating increase and decrease in their number together with their positions.

32. On a collection of Cestodes from Terai Forest—U.P.

L. N. Johri, Delhi.

Notopentorchis hindia n. sp. is obtained from *Dichoceros bicornis* from Terai forest area of U.P.

Specific Diagnosis :—The worm measures 32 mm. in length. The scolex globular bearing double crown of 22-24 hooks measuring, 14-16 u and 20-22 u long. Genital pores irregularly alternating. Genital ducts ventral to longitudinal excretory vessels. Testes 5, lateral and slightly posterior to ovary. Cirrus sac 118-136 u long crossing ventral longitudinal excretory canal. Ovary at centre of proglottis extending towards posterior margin of segment. Uterus a single sac containing egg-capsules. Egg-capsules bearing eggs singly. Eggs and onchosphere measure 22-25 u and 17-20 u respectively. Embryonic hooks 11-13 u long. Uterus sac anteriorly possesses paruterine organ, long, narrow with wavy margins and covered with prominent transverse fibrous markings.

Associated with the new form, some other worms (cestodes) are also found which are not fully developed.

33. Studies on the life history the fowl tapeworm Choanotaenia infundibulum (Block).

S. C. Dutt *and* P. K. Sinha, Izatnagar.

Uptil now 9 species of beetles, 2 species of grasshoppers and the house fly *Musca domestica* have been incriminated as intermediate hosts of *Choanotaenia infundibulum*. Horsfall and Jones (1937) in America studied the development of the cestode larvae in beetles and grasshoppers. The present paper gives a more detailed account of the life history of the parasite and records new intermediate hosts. Details of development in the definitive host have also been studied.

Beetles (16 species), grasshoppers (15 species) and grouse locusts (3 species) were found to act as experimental intermediate hosts of the tape worm. Natural infection was obtained from 2 species of beetles.

At 90°F. to 100°F. temparature mature cysticercoids were obtained from experimentally infected intermediate hosts in 5 days "Solid-ball" and "hollow ball" stages were found 6 to 40 and 42 to 64 hours respectively after infection. "Tail" was differentiated at about 68 hours. Definite connection between tail and cyst was demonstrated. Connection was generally severed during invagination of scolex but in a few cases was maintained all-through Tail is deeply stained in methylene blue.

Chickens have been infected by feeding cysticercoids from naturally and experimentally infected intermediate hosts.

Studies on the development in definitive host (chicks) at different intervals after infection, revealed that the parasite settles in the anterior portion of the jejunum by 24 hours and attains maturity as early as 8 days but gravid proglottids are not shed earlier than 14 days after infection.

34. Studies on the life-history and Biology of the Fowl Castode Raillietina cesticillus (Molin)..

S. C. Dutt, P. K. Sinha *and* K. N. Mehra, Izatnagar.

The paper deals with the details of development of *Raillietina cesticillus* in intermediate hosts. Some aspects of biology of the tapeworm in the definitive host have also been studied. Natural (4 species) and expeimental (10 species) intermediate hosts (beetles) of the tapeworm in India are recorded for th first time. The experimental hosts include *Cincindela sp.* of the family Cincindelidae, which is newly introduced as intermediary. Studies on seasonal incidence of cysticercoids in naturally infected beetles (1 species) revealed an average infection of 5.6%. The incidence was high during November to February.

In experimental infection of beetles and also their larvae mature cysticercoids were obtained in 30 days during January; 26 days during February-March, 16 days during March-April and 12 days in May. Onchospheres were seen entering the body cavity of beetles through the enteric caeca of the midgut. The 'tail' was found to be detached during invagination of scolex, but persisted in the body-cavity of beetles as long as the cysticercoids. The structure described as excretory vessicle by Wetzel (1934) has been shown to be the remnant of the channel connecting the cysticercoid and tail. The larvae of the parasite were not affected by the metamorphosis of the beetle larvae. Imparting infection over a long period, all the developmental stages of the cysticercoid were found to be present in the same host at one time showing the absence of any acquired immunity.

Experimental proof of the factor responsible for the periodicity of daily segment discharge of *R. cesticillus* in the definitive host has been furnished. The period was shifted by changing the hour of feeding of the host. Effects of starvation on segment production have been studied. Date of segment counts have also been presented.

35. Studies on the life history of Hymenolepis carioca, a cestode of poultry.

K. N. Mehra, Izatnagar.

Tapeworms of poultry constitute one of the major factors responsible for retarded growth, lowered resistance and reduced productivity of birds. A detailed knowledge of the life histories of these parasties is essentail for formulating rational control measures against them. With this object in view the life hostory of *H. carioca* was investigated. Large numbers of various types of arthropods were collected from the Institute Poultry Farm, where the infection was known to exist. They were dissected and examined for tapeworm larvae. One type of beetles, some of which have been sent for identification, was found to harbour fully developed cysticercoids which on being fed to one-day-old clean chicks developed into adult specimens of the parasite in a month's time. The number of cysticercoids obtained from a single beetle varied from 10 to 201. Different developmental larval stages from the onchosphere to the cysticercoids obtained from beetles have been studied. Fifty per cent of the beetles collected from the Farm were found to be infected with the larval stages of the tapeworm.

36. A study in the incidence of intestinal Helminths in Poultry at Izatnagar.

S. C. Dutt, Izatnagar.

During June, 1948, to March, 1949, 63 of the fowls that had died in the Poultry farms of the Indian Veterinary Research Institute were examined for intestinal helminths. 71% were found to be infected with one or more species. 56% harboured *Ascaridia galli* and 44% had *Heterakis gallinae* infection. 22% were infected with *Raillientina tetragona* and *R. echinobothrida* were found in 11%. Hymenolepis cantaniana were present in 5% and *R. cesticillus* and *Hymenolepis carioca* were found in 2% of the birds. 17% of the birds were infected with 1 species, 40% with 2 species; 11% with 3 species and 3% with 4 species. The number of worms were : *A. galli* 1-119, H. gallinae 1-250, *R. tetragona* 1-8, *R. echinobothrida* 2-8, *H. cantaniana* 200-1140, *R. cesticillus* 40 and *H. carioca* 140.

Choanotaenia infundibulum infections though prevalent in the farms were not encounted in the dead birds. *Amoebotaenia sphenoides* infection was found in a fowl sent from a neighbouring place (Kiccha). The occurrence of *Hymnolepis carioca* has not been previously reported from any part of India.

37. Studies on the life-history of Trichuris ovis.

P. G. Deo, Izatnagar.

In one of the previous experiments on the life-history of *Trichuris ovis* an artificially infected lamb revealed the presence of 689 immature worms from the stomach and small intestine, 48 days after the infection. In the other experiment, one of the artificially infected kid revealed the presence of 362 worms in the small intestines, 85 worms in the large intestine and 466 worms in the caecum, all being immature, 61 days after infection. The second kid in the same experiment passed an unsegmented egg in the faeces 85 days after the infection. This kid was slaughtered along with the control kid 136 days after the infection and 135 mature worms were recovered from the caecum, the control being negative.

In order to verify the results of the last two experiments, an experiment was conducted and it was found that the kid infected with the infective eggs of *T. ovis* passed an unsegmented egg in the faeces 135 days after the infection. Its post-mortem exa. amination, 161 days after infection, revealed the presence of 99 mature worms of *T-ovis* in the caecum. The mucous membrane of the affected kid was slightly congested, highly striated with numerous folds and zigzag stripes and thickened to a considerable extent, while that of the control kid was normal, thin, not striated and without any congestion.

38. An acanthocephalan parasite—Acanthogyrus acanthogyrus—from a common fresh-water Fish Labeo rohita from Bareilly.

P. G. Deo, Izatnagar.

Several specimens of an acanthocephalan worm, *Acanthogyrus acanthogyrus*, were collected from the intestine of a fresh-water fish *Labeo rohita* in 1946-47. The collection consisted of large and small specimens of the species. The small specimens resembled exactly those collected and described by Thapar (1927) while the arge specimens differed in some of the characters, though the external characters were similar. The following significant differences have been noted from the original description : —

1. The variation in the size of the worms in both the sexes.
2. The variation in the number of rows of spines on the body.
3. Presence of ten hooks in the posterior row of hooks on the proboscis.
4. Presence of vesicula seminalis in males.
5. Variation in the number of prostatic glands.
6. Variation in size of testes.
7. Presence of ovary in the young specimens.

The author is of the opinion that the large specimens described in this paper are the mature specimens of this species while the small specimens representing these collected by Thapar are the immature forms of the same.

ANNULATA

39. The Role of Open and Closed Nephridia in Oligochaete Excretion.

K. N. Bahl, Lucknow.

The "Urine" of two kinds of earthworms, one with open nephridia and the other with closed nephridia, was examined to determine the physico-chemical characters and the chemical composition of each. A comparison of the pH, the depression of freezing point and the chloride and sodium contents indicates that while the closed nephridia are largely concerned with the regulation of the water content of the body, the open nephridia have taken on the additional function of getting rid of wastes.

40. On the limit of segment in the Arhynchobdellid Leeches.

M. L. Bhatia, Delhi.

The body of a leech is divided into hundred or more annuli, while true segments are only 33. Most authorities agree that a typical complete segment includes 5 annuli. In the absence of a spacious body-cavity and in the total absence of septa of the type present in earthworms, the exact limit of a segment has not been finally defined, There exist two views about the limit of a segment. One is supported by Whitman and Gratiolet who regard the nerve ganglion of the ventral nerve chain in the first annulus of the somite, the other view is put forth by Castle and Moore according to which the nerve ganglion is in the centre of each segment.

By the study of external morphology, internal anatomy and embryology of *Hirudo* and *Hirudinaria*, it has been possible to solv the controversy and to settle once for all the exact limit of a segment in leech. Observations go in favour of Whitman and Gratiolet view, to regard a nerve ganglion in the first annulus of a segment.

CRUSTACEA

41. Observations on the movements and locomotion of Daphnia longispina.

N. K. Singh, Agra.

The author has studied the bionomics of the water-flea and made minute observations on the movements of the eye, the thoracic appendages and the abdomen. The jerking movement is not caused, as believed by other authors, by the second antenna, but is initiated by the spined abdomen. The rates of the heart-beat and that of the vibration of the antenna have been calculated ; the food-mechanism has been studied The posterior vibratile hair-like processes attached to the soft mass of tissue below the abdomen are mobile cuticular structures and contrary to what is given in various text books and works of reference cannot be regarded as setae.

42. Sex differences in Pelagic Copepoda.

S. Krishnaswamy, Madras.

The Copepods exhibit a large number of variations in the external form of the two sexes, from a mere difference in size to the most marked differences which led the old writer like Claus to classify the males of some of the species in separate genera. The differences are mainly in size, shape, the number of joints in the abdomen, the modifications of the antennule and the fifth leg. (1) *Size* : The male is smaller than the female. But in *Euterpina acutifrons* the male is more or less of the same size as the female and in *Copilia mirabilis* the male is larger than the female. (2) *Prehensile organs* : The antennule is generally modified for grasping in the male. In forms like *Centropages furcatus* the right antennule is very swollen, hinged, distal part capable of being flexed over the proximal part. In many Calanoida the fifth leg is also prehensile in the male e.g., *Labidocera, Pontella*. In *Harpacticoids* and *Cyclopoids* the modification of the antennule is always bilateral as in *Euterpina acutifrons* and *Oithona rigida*. Informs like *Oncaea, Corycaeus* and *Corissa* the maxilliped is prehensile in the male. (3) *The number of joints in the abdomen* : The abdomen is three jointed in the female and four jointed in the male as in *Mecynocera clausii* or it is two jointed in the female and five jointed in the male as in *Calocalanus pavo* or it is four jointed in the female and five jointed in the male as in *Kelleria rubimaculata*.

43. Breeding-Seasons of the Copepods of the Madras Plankton.

S. Krishnaswamy, Madras.

The evidences of the breeding-seasons, such as the presence of naupli, early copepodites, the occurrence of Copepods in copula are described. The Copepods of the Madras Plakton can be divided into three groups on the basis of their breeding habits. (a) forms that breed through out the year e.g., *Euterpina acutifrrons, Oithona rigida* (b) forms that breed in certain months e.g., *Pseudodiaptomous aurivilli, Macrosetella gracilis* (c) forms that do not show any indication of their breeding in the inshore waters e.g., *Undinula vulgaris*. As observed by Wilson (1932) "each season begins towards the last of the month preceeding and continues into the month following". The breeding activities are at their peak in July, September, December and March. The breeding of the Copepods is definitely periodic. As suggested by Orton (1910), a correlation of the temperature with breeding seasons shows that breeding takes place when the temperature ranges from 23.5°C. to 26°C.

44. Observations on the development and parental care in the Potomonid Crab, Paratelphusa (Barytelphusa) Jacquemontii (Rathbun).

P. I. Chacko *and* S. Thyagarajan, Madras.

This crab breeds along the rocky margins of the supply channels and Cauvery river in the Mettur dam area, in the month of February, March and April, when the flow and level of water is mild and low. The number of eggs in a sponge varies from 360 to 420. The eggs are spherical, 1.6 to 2.0 mm. in diameter, and orange-coloured. Development is rapid, all the larval stages being atrophied. The young ones, with a form completely resembling the adult, break open the egg shells on the sixteenth day, but remain in the brood-pouch. The parental care lasts for about 22 days, at the end of which pcirod, the young ones, 4 mm in length and 5 mm in width, leave the mother to lead an independent life. Ecology of the breeding area, details of development and parental care are described.

ENTOMOLOGY

45. Effect of Temperature on Toxicity of DDT Films.

S. Pradhan, New Delhi.

A series of exploratory experiments on the relationship between temperature and toxicity of DDT films to adults of *Tribolium castaneum* Hbst. and larvae of *Plutella maculipennis* are described. The main observations with *T. castaneum* are :—

(1) When the insects are continuously kept on the film at different temperatures there is higher kill at higher temperatures.

(2) When the insects are exposed to the film for about 24 hours at the same temperature and then kept away from it at different temperatures there is a higher kill at the lower temperature.

(3) When the insects are kept on the film at different temperatures for about 24 hours and then kept away from the film for reaction at the same temperature, there is higher kill in those kept on the film at higher temperature.

With larvae of *P. maculipennis* the observations Nos. 1 and 2 remain unchanged but No. 3 is reversed. The probable cause of this reversal appears to be the observed fact that at higher temperature these larvae cover the film with much more silk thread and thus avoid the film to a greater extent than at lower temperatures.

The above experiments and a review of literatures indicate that many of the observations made upon the temperature-toxicity relationship can be accounted for by the following generalisations :--

(1) Insect resistance to poisons changes with temperature as do its other vital activities, increasing up to a critical degree and afterwards declining.

(2) The amount of poison reaching the site of action in unit time varies with the temperature, generally but not always increasing with its rise. Insect activity, specially locomotor and respiratory, may play an important part in these effects.

(3) The apparent effects of temperature on insecticidal action is the combination of these two factors, namely, resistance and pick-up.

46. Effect of Relative Humidity on Toxicity of Insecticide Films.

S. Pradhan, New Delhi.

Experiments on the effect of changes in relative humidity on toxicity of DDT and DNC films to adults of *Tribolium castaneum* Hbst. and larvae of *Plutella maculipennis* Curtis are described. With *T. castaneum* adults the toxicity of both DDT and DNC films is increased at higher relative humidities, but with larvae of *P. maculipennis* the toxicity of DDT film decreases while that of DNC film increases at higher humidities. Like these experiments the perusal of literature also does not help to deduce any general principle. However, it is possible to collect instances showing that besides the insect and the insecticide, there may be various factors like the range of humidity tested, the strength of the insecticide used, the stage of the insect, etc., which can affect the observation on effect of humidity changes.

47. Effect of Concentration on Temperature Coefficient of DDT action on insects.

S. Pradhan, New Delhi

Recently Fan Cheng and Glenn Richards (1948) reported from Minnesota that following external application, the temperature coefficient of DDT action in insects is a function of DDT concentration or dosage and that it is positive at high concentrations and negative at low concentrations From these observations they concluded that "at low concentrations DDT penetrates the arthropod cuticle more effectively at low temperatures "

In the present contribution it has been shown that the experimental data published by the above authors do not justify such a fundamentally unexpected conclusion as quoted above and that they satisfactorily fit in the three fundamental generalisations recently reported elsewhere by the present author

48. Relation between specific susceptibility of insects to HCN and the amounts of HCN recovered after fumigation from different species of insects.

S Pradhan and S. C. Bhatia, New Delhi.

Insects were fumigated in two lots with several concentrations of HCN, the exposure time being kept constant. From one lot of insects, mortality was studied after 48 hours and from the other lot of insects, HCN was recovered by distillation and estimated by a colourimetric method

The percentage mortality in different species could be positively correlated (*a*) to the different concentrations of HCN used in fumigation and (*b*) to the amounts of HCN recovered per gram body weight of the corresponding lots of insects after fumigation There was nothing extraordinary so far as these correlations were studied separately, but the comparative positions of different species in these two correlations appeared to be paradoxical. The same species which appeared to be the least susceptible on the basis of the first correlation (i.e, adult females of *Drosicha sp*) also appeared to be the most susceptible on the basis of the second correlation

In order to explain this apparent anomaly the following assumptions have been put forward :--

(*a*) that there is an *apparent resistance* of a species which is shown by plotting the values of the percentage mortality against the concentrations of HCN used in fumigation.

(*b*) that the *apparent resistance* is a function of (*i*) *surface resistance*, i.e., the capacity of the insect to resist the entry of HCN into the insects' system and (*ii*) *internal resistance*, i.e, the capacity of the insect to resist the toxic effects of HCN.

The insects used for the study were (1) 7th instar caterpillars of *Corcyra cephalonica* Staint (Fam. Pyrallidae : Lepidoptera), (2) adults of *Tribolium castaneum* Hbst. (Fam. Tenebrionidae : Coleoptera) and (3) 1st—2nd stage nymphs, (4) 3rd—4th stage nymphs and (5) the adult females of *Drosicha* sp. (Fam Coccidae : Homoptera).

49. A note on the Insecticidal properties of Annona Squamosa (Linn).

Mohan Babu Naidu and Syed Husain Zaheer, Hyderabad Deccan.

Annona squamosa (Linn) was investigated to determine its insecticidal properties. When tested for contact poison against Aphids, seed extract and expressed oil were equally toxic. The petroleum ether insoluble portion derived from ether extract was slightly more toxic to Aphids than ether soluble extract. As a stomach poison the insecticide was effective even in small concentrations to Saw-fly larvae (Athalia Proxima, K). and to adult Pumpkin Beetles (Aulacophoea foveicollis, K). Encouraging results were not obtained when tested for residual action.

50. Studies on the control of Poultry Lice.

P. B. Menon and C. M. Sen Gupta, Izatnagar.

A series of experiments were conducted to determine the effectiveness of DDT, Derris powder, Sodium Fluoride and mixture of Derris and DDT on poultry lice. Insecticides were used in various proportions.

5% and 2.5% DDT and mixture containing DDT and Derris (2.5% and 5% respectively) were found equally effective both in killing and residual effect. 10% Derris had the similar killing property but was found less effective in residual effect. 33% Sodium Fluoride had practically no residual effect.

51. Certain Aspects of Taxonomy in Insects.

A. P. Kapur, Kashmir.

The functions of taxonomic entomologist can be conveniently divided into the following four categories : (1) Curatorial, (2) Routine determination, (3) Separation of new species including their description and (4) Classification.

The curatorial work is discussed with special reference to the Insect Collection in the Zoological Survey of India and the Indian Museum, and an estimate given of the extent of the collection. The importance of a large collection cannot be over emphasized for taxonomic studies and a plea is made for a further development of this largest National Collection.

Species are naturally composed of 'population units' the members of which are often more homogenous than the different units. The latter are supposed to interbreed although they may be defined by discontineous ecological and topographical conditions. In the vast majority, however, the species stand out as collection of populations in which the resemblances outweigh the differences. Since there is a certain amount of variation in even a 'population unit' it is better to try and determine even a small sample than a single specimen. Apart from giving names to the insects mainly for the benefit of other workers the purpose of identification is also to make certain predictions regarding their habits, etc.

Species are usually separated from one another by a number of characters wihch show various degrees of discontinuity. The different characters are then correlated with one another and the species, new or already known, defined. Not only the morphological characters but the biological ones also are taken into account for this purpose.

A good classification makes possible useful predictions about unfamiliar species. Undoubtedly a classification based on the phylogeny of a group is better than any other. In the absence of fossil evidence the phylogeny of a group is to a certain extent elucidated by such studies as comparative morphology, embryology, geographical distribution, etc. A classification that makes no phylogenetic claim would be of limited use mainly for routine identification.

52. Biology of *Afidenta gradaria* (Mulsant) with Notes on the Identity of other Epilachninae damaging Vegetable Crops in India (Col. Coccinellidae).

A. P. Kapur, Kashmir.

Afidenta gradaria (Mulsant) has been found feeding on various kinds of beans in Calcutta and in Muzaffarpur (Bihar). Although originally described in 1850 from Calcutta and Coromandel, it has not been reported in any subsequent papers on Indian entomology and has apparently been confused with other species of *Epilachna* with which it agrees in the number and pattern of the black markings on the elytre. The species (or its subspecies and varieties) is distributed in Java, Malaya, Indochina and China, and the records on the labels borne by the material from the former two countries show that there also it feeds on bean leaves. The life-history and the feeding habits are described and the means of distinguishing the various stages of this species from those of other common Epilachninae in India are given.

53. Statistical analysis of variability in body-size, etc. of various types of individuals of Desert Locust (Insecta : Orthoptera : (Acrididae).

M. L. Roonwal *and* M. K. Nag, Calcutta.

In continuation of a previous paper (Roonwal, *Rec. Indian Mus,*, vol. 45 pts. 2 & 3, 1947 (1949), pp. 149-165), a rigid statistical analysis was undertaken of the sizes of certain body-parts, *e.g.*, the length of the elytron (E), the hind-femur (F), etc. and the ratios of some of these, *e.g.*, E/F, etc. belonging to some important types of indivuduals of the Desert Locust, *Schistocerca gregaria* (Forskal), *viz.*, phase *gergaria* 6-eye-striped, phase *solitaria* 6-eye-striped and phase *solitaria* 7-eye--striped, the last two being of the blue-grey type. 'Fawn'-type *solitaria* forms were also studied, from a very small number of observations. Means, standard deviations and coefficients of variation with corresponding standard errors for each character were calculated and the significance of the differences in mean values among various types were statistically tested. In regard to fawn type *solitaria* the confidence limits of the mean-values were found out. *Conclusions* : (i) Within each group, the females are larger than males in respect of all the body-parts, the sexual dimorphism being greatest in 7-striped *solitaria* and least in *gregaria*. (ii) Regarding E and F among females, and F alone among males, the *regaria* individuals are the smallest, 6-striped *solitaria* larger, and 7-striped *solitaria* the largest. The differences are not significant among the male elytra. (iii) The mean E/F ratio is the lowest in 7-striped *solitaria*, higher in 6-striped *solitaria*, and the highest in *gregaria*.

54. Reduction in Milk Yield in Indian Dairy cattle by arthropod invasion and its control.

B. C. Basu and C. M. Sen Gupta, Izatnagar.

The paper deals with the result of a series of experiments conducted to determine the reduction in milk yield in Indian Dairy Cattle caused by arthropod invasion and to work out easy methods to control it.

The previous work on this subject is discussed.

55. Distribution of Tabanus Flies and its Correlation with the incidence of Surra in India.

B. C. Basu, Izatnagar.

The paper deals with the regional distribution of the Indian spieces of tabanid flies and its correlation with the incidence of surra in India. The paper is illustrated with charts and tables showing incidence and maps showing distribution.

56. Breeding of *Tabanus rubidus* Wiedemann in captivity.

B. C. Basu, Izatnagar.

Observations on the egg-laying habit of *Tabanus rubidus*, Weidemann in captivity and on rearing of the larvae are reported in this paper.

ECHINODERMATA

57. Observations on the effect of a new antibiotic substance upon sea-urchin eggs.

Alexander Wolsky, Delhi.

The author reports on experiments carried out on eggs of Echinocardium cordatum and Psammechinus miliaris with raphanin, an antibiotic substance isolated from seeds of the radish (Raphanus sativus) by Ivanovics and Horvath (Nature, **160**, 297, 1947). The substance stops mitosis of Echinocardium eggs in a concentration of 1 : 125.000 and disturbs development (prevents gastrulation) in 1 : 2,000.000. Psammechinus eggs are more resistant and there are even individual differences between eggs of the same species as regards resistance. The differences are correlated with the cortical reactions at fertilization (formation of fertilizaton membrane) : the stronger the cortical reactions, the greater the resistance, Resistance also increases during cleavage : in the 2-cell stage the eggs are more susceptible than in blastula stage. These and other observations (unequal cleavage, fragmentation of cytoplasm) indicate that the surface (Cortical layer) of the eggs and blastomers plays an Important role in determining the effect of raphanin. Development of cilia and ciliary.motion are not affected by concentrations which stop other developmental processes (1 : 250,000). Basal metabolism as measured by oxygen uptake is not depressed by concentrations which stop development (1 : 500 000) Control experiments with the well-known mitotic poison colchicin, were also carried out for comparison.

PISCES AND FISHERIES

58. An adjustable fish pass for the experimental collection of data.

B Sundara Raj, Lucknow.

Costly fish passes constructed in India have failed because of unsuitability for Indian fish. A successful fish pass can only be constructed after experimentally ascertaining the slope, velocity and discharge negotiable by different species and by the same speices at different ages. The Indian Council of Agricultural Research sponsored a scheme but it could not be worked for want of these data. The transport of fish of all sizes and varieties is impracticable. I have therefore designed a portable and adjustable pass to obtain these data easily in any required place

The apparatus consists of :—

1 Inlet channel with regulating sluice and removeable bag net to trap ascending fish.

2. Fish pass proper with a slope of 15° and a false adjustable bottom plate with baffles. With this the gradient can be regulated from 15° to 0. The permissible slope of a pass being 1 in 5, the entire range is covered.

3. Resting pool with adjustable net lining. *Method.*– Collect fish and place in the resting pool net after noting sizes and species. Admit a flow of water of known volume, depth and velocity. Adjust flow until fish ascend. Reluctant fish can be coaxed by gently raising the net Thus the needs of any species and size of fish can be determined.

59. Some Aspects of The Natural History of *Clupea lile*.

H. K. Mookerjee and R. Bhattacharya, Calcutta

Clupea lile, according to Day, is an inhabitant of the west coast of India. But in the recent collections from canning river this fish has been found in swarms even in the east, *Clupea lile* is not available in Canning river throughout all the seasons of the year, but its availability is restricted to a certain period covering the months from April to October. It migrates in the river in its younger stages and after attaining a considerable size returns again to the sea.

No direct evidence has yet been obtained on its breeding habits, but its young ones are found in the river up to June. Presumably its breeding season prolongs from December to May.

Its growth rate in relation to length, breadth and weight of the body has been studied. In April the Average Mean Length is 25.5 mm., the Average Breadth is 7 mm. and the Average Weight is 353 mg. These A. M. L., A. B. and A. W. of the fish increase gradually month to month and in October they have been recorded to be 72 mm. 25.5 mm. and 2370.4 mg. respectively.

The dietary of *Clupea lile* consists of some algae and benthoic crustacea. Among the algae : *Oscillatoria sp. Ulothriz sp., Hydrodictyon sp, Coscinodiscus sp., Lyngbya sp., Cyclotella sp., Navicula sp.* and some spores are found in its stomach contents. *Daphnia sp., Cyclops sp., Calanus sp , Eubranhciata sp., Mysis sp.*, various kinds of decapods like small shrimps and crabs, and various crustacean stages like Zoea, Megalopa, Cypris, and Nauplius are the chief bodies of the crustacean diet. The percentage of algal diet is not more than 3% in any case.

Silicate matter forms only 2% of the whole stomach contents in the early stages, but over 50 mm stage it becomes very negligible. Crustacean diet forms the main bulk of the food. Again examining the post-intestinal contents it has been found that most of the algae remain undigested. Evidently it may be said that the fish is a carnivorous one and chiefly lives on crustacea.

60. On some Aspects of the Natural History of *Engraulis Hamiltonii*, and *Engraulis telara*.

H. K. Mookerjee and P. S. Mookherji, Calcutta.

Engraulis Hamiltonii and *Engraulis telara* have a common name Phansa in Bengal. Developing stages of both the species have monthly been collected from a salt water bheri at Ghutiyari Sheriff, 24-Parganas. Stomach contents of both the species at various stages have been examined and found to constitute the same articles of food. They take abundant quantity of crustacea mainly the copepods and macrurans and little amount of vegetable matters embodying some unicellular species of Myxophyceae and Chlorophyceae. Occasionally diatoms, mainly centrics, could be found in the stomach contents All the previous workers on food of fish examined only the stomach contents and regarded them as food of fish. But we think that this type of work is far from satisfactory for the determination of food. Much depends on the condition of digestion of the food taken. For this purpose we have examined the condition of the post-intestinal contents (contents of the posterior most part of the intestine) of each fish and their average results have been taken. Thus it may be said that the main food of these two species at their different stages is crustacea while the vegetable matters may be regarded as the accessory food or roughage as they are always found undigested or partly digested. Regarding variation of food we can state that it varies with regard to quantity rather than quality in different seasons of all the year round.

The fish possess some sort of selective habit as they take only the animal food (crustacea) when the bheri is rich in both phyto- & zooplanktons. In this case the fish may be called as surface feeder as they devour only the crustaceans which naturally thrive on or near the surface of the water.

Breeding season of the fish begins from January and prolongs up to the end of July. The fry of the two species could be availed as long as to the first part of August.

61. Spawning and development of *Cirrhina reba* (Ham.)

P. I. Chacko, Madras.

This junior carp attains maturity at the end of the first year and spawns in rivers from July to October. The hydrological conditions of the rivers at this period are studied. The fertilised egg is transparent and measures 3.0 mm. in diameter. Segmentation commences within 30 minutes of laying ; and the embryo becomes prominent at the sixth hour. It measures 1.85, 2.2 and 2.6 mm. at the 8th, 10th and 12th hours respectively. The optic and auditory vesicles and the heart appear at the 12th hour. Hatching occurs at the 14th hour ; and the larva measures 3.35 mm. long. Pigmentation commences at the 4th hour. The absorption of the yolk-sac and the formation of mouth coincides on the 3rd day. In the 2nd week the larva measures 11 to 15 mm., and shows a bluish lateral band and 3 to 5 black spots on the caudal fin. It grows 30 mm. long in 6 weeks. The adult features are assumed within 8 weeks. Further details are recorded. The fish attains a size of 10 to 15 inches in one year ; and its suitability for rural pisciculture is discussed.

62. On the Bionomics of Buchanan's Carp, *Barbus curmuca* (Ham.).

P. I. Chacko, Madras.

This carp occurs in the rivers of the Malabar and South Kanara districts. The conditions of the hill stretches of four rivers, namely, the Mannantoddy, Panamaram, Netravati and Suruli rivers, in which it breeds during the S. W., Monsoon are detailed. The diet of the fish consists of plantonic organisms and aquatic insects. The migration of the fish is indicated.

63. A study of the Ecology and Bionomics of Indian Carps Catla Catla (ham), Labeo Rohita (ham), Cirrhina Mrigala (ham) Cultured in the sewage Irrigated Fish Farms near Calcutta.

S. P. Basu, Calcutta.

Sewage irrigated fish culture is being carried out in the defuct Bidyadhori spill area (the so-called "salt lakes" Calcutta). Salt lakes cover an area of 75 square miles, of which 50 square miles is marshy and unsuitable for agriculture. Out of these 50 square miles, twenty seven have been converted into fisheries yielding 120,000 maund (4,445 tons) of fish annually. Production can be increased to 3 lakh maunds (11,100 tons) by utilising all the marshy places with proper administration of sewage. Standardization of sewage feeding is, therefore a problem of great economic importance.

Fisheries in this area are shallow and on an average 2′ 3″ of water is maintained. Sewage is fed once a month during the summer and winter months, while during monsoon months, the fisheries are drained off to check overflooding. Sewage is allowed to enter against the direction of wind and 30 to 40 million gallons of sewage is mixed with 100-120 million gallons of fishery water slowly in course of 5-10 days, thereby reducing the chance of sudden pollution and fish mortality during sewage feeding. Fisheries are dried up for 1 or 2 months for periodic cleaning of vegetation and drying the bottom. Sometimes paddy is cultivated as an alternating crop to prevent soil getting sewage sick. Different concentrations of sewage in a number of experimental ponds in which dosage and other conditions can be controlled, were tried and experimental observations recorded. Experimental observations have been checked with the observations in bigger fisheries namely Hanakhali and Charchania, 600 and 250 acres respectively.

Typha sp, *Pistia*, *Vallesnaria*, *Hydrilla*, *Ceratophyllum*, *Eichornia*, different species of *Cyperus* and *Lemna*, etc., form the natural aquatic vegetation while *Panicum sp*, *Alternenthera* and *Siveada* form the terrestrial vegetation. A marked seasonal variation in the above vegetation is noted. Vallesnaria with flowering stages is prominent in January and February. Zoo & phytoplankton prominent in summer, moderate in monsoon and negligible in winter. Cladocera prominent in summer, copepoda and rotifer in monsoon and *Tribonema* and *Oedogenium* in winter.

Ophicephalidae Siluroidea, Anabantidae, and Minnows form a natural bye product in these fisheries in addition to carps cultured therein. In course of a year from 1 cm. fry *Cala catla* (Ham), *Laeo rohita* (Ham), and *Cirrhina mrigala* (Ham) attain a length of 40 cm. 30 cm. and 25 cm. and weigh 1¾th lb. 1½ lb. and 1 lb. respectively.

Sewage fed to the fisheries has 100-115 p.p.m. B.O.D., ; pH 6.8—7, D.O.—nil—1 p.p.m. CO2 32.5-37.5 and offensive smell and black colour. During sewage feeding, in the zone of pollution— D.O.– nil, pH 7.1-7.3, CO2--12-20, B.O.D. 70-92.5

and turbidity increased. No aquatic life. Zone of recovery D.O. 5.6-6.1, pH 8.0-8.2, CO2 1-2, B.O.D. 20-30. Plankton and aquatic life increase. Diurnal fluctuation of D.O. and pH recorded indicate 6-14.6 p.p.m. and 8-9.8 respectively.

In summer B.O.D. decreases to normal after 10-12 days and winter 15-20 days. Increase in phosphate and nitrate from 0.25 to 0.5 and 0.1-0.15 respectively after sewage feeding. Gradation of pH is observed in different places of fisheries according to the amount of submerged vegetation from 7.6-9 respectively. After sewage feeding bacteria increases on the 1st day followed by increase in protozoa and phytoplankton on 2nd and 3rd day. Rotifer and crustacea increase on the 4th and 5th day respectively. Decrease in phytoplankton is followed by the decrease in zoo-plankton.

64. Food habits of the catfish, *Callichrous macrophthalmus* (Blyth).

P. I. Chacko and S. Thyagarajan, Madras.

The food and feeding habit of *Callichrous macrophthalmus* which congregate in the two supply channels of the Mettur Dam in the months of February and March, when the discharge of water is reduced from 750 to 30 Cusecs, are discussed. Fingerlings of *Cirrhina reba* were present in 68 guts, *Labeo kontius* in 38, *L. fimbriatus* in 21, *Barbus stigma* in 16, unidentifiable fish remains in 37, and aquatic insects in 38. Suggestion for checking the adverse effect on the carp fisheries of the piscivorous tendency of the catfish is indicated.

65. Adaptive modifications in a hillstream cat fish, *Glyptothorax telchitta* (Hamilton)—Part 1. Epidermal Adhesive Organs.

Bimla Bhatia, Delhi.

This paper (part 1 of the series) deals with the epidermal organs which serves adhesive function, in a small fish *Glyptothorax telchitta* found in fast flowing streams of Rihand River, Mirzapore, U. P. Due to the resistance offered by the fish against strong water currents number of epidermal adhesive devices are developed in it which help the fish to maintain a more or less stationary position.

These are :

(*a*) *The Rostral hood*, i.e., the region in front of the mouth which is a secondarily formed covering over the anterior lip. It is pad-like and is profusely papillated subserving an adhesive function. (*b*) *The posterior lip* region is also papillated and the papillae are longer than those in the rostral hood. (*c*) The region of the *Branchiostegal rays* has a grooved integument which bears short stout spines, and (*d*) *The Thoracic adhesive apparatus*, a marked rhomoidal area on the ventral chest region, where the integument is longitudinally pliated. The ridges are provided with long curved cuticular spines which help the fish to stick to the substratum.

66. On factors influencing the reduction of the dorsal fin in some Indian Siluroid and other fishes.

N. N. Majumdar, Delhi.

On a general survey of fishes one comes across a variety of fishes some with long and other with a short dorsal fin. The length of the dorsal fin varies considerably and it seems to depend upon the shape of the body. The greater the lateral compression of the body, the smaller is the dorsal fin. But this lateral compression must be greater ventral-wards, i.e., below the middle line of the body. Such a condition is most apparent in *Wallago*, *Heteropneustes*, *Callichrous*, etc.

The other factor influencing the length of the dorsal fin appears to be the smallness of the abdominal cavity. Fishes with a reduced dorsal fin are carnivorous and as such they have a small length of intestine. To accommodate this small length of the intestine they require a comparatively smaller abdominal cavity. Small abdominal cavity gives less upwards thrust than that of a herbivorous one thereby helping in the reduction of the dorsal fin.

67. On the natural history of the Olive Carp, *Barbus chrysopoma* Cuv. & Val.

P. I. Chacko, and B. Krishnamurthi, Madras.

The olive carp contributes to a commercial fishery in the South Kanara and and Tanjore districts. It occurs in rivers and tanks and attains maturity when 5 inches in length. It breeds in river sections having submerged rocks or vegetation, during the rainy season. The conditions of the spawning areas are given. The fish attains a maximum size of a foot within one year. It feeds on plankton, filamentous algae, aquatic insects and worms. A comprehensive analysis of the food organisms is also given.

68. Food Organisms of *Labeo boga* (Ham.).

P. I. Chacko and B. Krishnamurthi, Madras.

Three species of *Myxophyceae*, eight of *Chlorophyceae*, nine of *Diatomaceae*, three of *protozoa*, three of *rotifera* and five of *cladocera* constitute the food organisms of this fluviatile species of Carp. Of these, *Microcystis*, *Spirogyra*, *Amphora*, *Melosira*, *Navicula*, *Euglena*, *Ceriodaphnia* and *Diaptomus* occurred in more than 50% of the guts examined. The highest percentage of thirty in any stomach was formed by *Amphora*, *Melosira* and *Navicula* in separate specimens. The suitability of the species for pond culture is discussed.

69. Prawn shell meal as fish-food.

P. I. Chacko and B. Krishnamurthi, Madras.

The rate of growth of fry of four species of fish, *Labeo kontius*, *Cirrhina reba*, *Barbus hexagonolepis* and *Labeo calbasu*, when fed on prawn shell meal, has been recorded for a periods of four months. The growth is twice greater than the normal growth in the case of *Cirrhina reba* and *Labeo calbasu* and four times in the case of *Labeo kontius* and *Barbus hexagonolepis*. The meal is also relished by other species like *Osphronemus gorami*, *Etroplus suratensis*, *Labeo fimbriatus*, *Gariamullya* and *Danio aequipinnatus*. Chemical analysis of the prawn shell meal showed that it contained 41% protein, 6% insoluble matter, 5% fat, 5% carbohydrates, 5% crude fibre and 38% lime and phosphates. This waste product of the prawn curing industry can thus be used for fattening fish.

70. On the scale-pattern of certain Indian Teleosts.

•D. N. Ganguly and S. P. Sarker, Calcutta.

The arrangement of scales in a large number of Indian teleostean fishes were studied. It was found that every species possessed a definite pattern which is never repeated in another one. The length-breadth ratio of the exposed surface of the scales of the different species also differs much. According to the authors, the scale-pattern can be used for the specific identifications.

71. On the nature and function of the tongue in fishes.

D. N. Ganguly and S. P. Sarker, Calcutta.

The buccal cavity of a large number of teleostean fishes was examined. It was found that the tongue is present only in those species which snap at anything living and take comparatively big sized swimmers like, fish, fish-fry, prawn, shrimp, etc. The details of the morphology and histology of the tongue were studied and the primary nature of the tongue was also discussed. The study suggested that the tongue of the fish is designed for the prevention of the slipping out of the living prey from the buccal cavity.

72. Notes on the natural history of four species of fish from the Tungabhadra River.

P. I. Chacko and M. J. Mathews, Madras.

(1) *Schismatorhychus* (*Nuhta*) *nuhta* (Sykes) attains 2 feet in size and attains maturity when 10 cm. in length. Its food consists of diatoms and desmids. Its culture in the Bellary fort moat farm has given satisfactory results attaining a size of 10 to 12 inches in 8 months. (2) *Puntius kolus* (Sykes) is one of the commonest carp in the river. It

spawns at the onset of S. W. monsoon. Suitability for pond culture is indicated. Food consists of planktonic organisms and aquatic insects. (3) *Callichrous pabo* (Ham.), is a rare species and its occurance in this region is recorded for the first time. Macrocrustacea, small and young carps, aquatic insects and leeches form its food. (4) *Rita hastata.* (Val.) feeds on caddis fly larvae, water beetles, shrimps and rotifers.

73. Notes on the Grey Mullets (*Mugil spp.*) of Krusadai Island. Gulf of Manaar.

K. Chidambaram and G. K. Kuriyan, Madras.

Grey mullets constitute an important group of fishes hugging the shores of Krusadi and nearby Islands in the Gulf of Manaar. The three important species constituting the fishery are :—

(1) *Mugil troschelii* (Blkr),
(2) *M. waigiensis* (Quoy & Gaim), and
(3) *M. seheli* (Forsk).

The food of these adult and fry of these three species are presented and discussed. The characters for identifying on the field the fry of *M. troschelii* and *M. waigiensis* are given in view of their importance for pisciculturists as the cultivation of mullets in marine and freshwater farms is gaining more importance in this country than ever before.

74. Occurrence of Fish Larvae and Post Larvae in Bombay Waters during 1948-49.

S. V. Bapat and D. V. Bal, Bombay.

The occurrence of larvae throws some light on the breeding season of fishes and so a systematic investigation of young forms of fishes occurring in Bombay waters has been undertaken since May, 1948. Pelagic fish larvae and post larvae have been obtained from plankton samples taken twice every week from waters around Bombay.

During the last year, 2005 young fishes from 118 plankton samples have been studied and assigned to 32 species and 22 genera. Details regarding their occurrence and seasonal fluctuations have been discussed in this paper.

Larvae of *Megalops cyprinoides, Engraulis kammalensis, Hemiramphus ectuntio, Polynemus tetradactylus, Therapon argenteus* and *Apocryptes serperaster* were fairly common in these collections. Further the young forms of *Dussumieria hasseltii, Bregmaceros macclellandi, Trichiurus savala* and *Drepane sp.* have been recorded for the first time from Bombay waters.

75. On the hydro-biological data collected in the Wadge Bank early in 1949.

K. Chidambaram and A. D. Isaac Rajendran, Madras.

Fishing operations were conducted in the Wadge Bank during February, March and April of 1949 with the help of the Madras Fisheries Departmental vessels. This opportunity was availed of in gathering certain hydro-graphical data and Biological data on the fishes of the locality. The chief kinds of fishes examined were *Epinephelus tauvina* (Forsk), *E. miniatus* (Forsk), *E. bleekeri* (Vaill and Bocourt), *E. undulosus* (Q. G.), *Lutjanus malabaricus* (Bl. Schnr) and *Aprion typus* (Blkr.). The summary of the data on their length, weight, sex, condition of gonads and stomach contents is presented in this paper.

76. The Fish-fauna of the Kitham Reservoir, Agra.

Kr. Balwant Singh, Agra.

The author has studied the topography and hydrobiological conditions of the Kitham Reservoir in relation to its fish-fauna. The reservoir is a natural perennial stretch of water, biggest in the whole district, being seven sq. miles in area with a maximum depth of 25 feet, is supplied by the Delhi-Agra Canal, and empties into the river Jamuna by the Kitham Escape. The fishes so far collected belong to 39 species, 25 genera and 9 families, of which some are recorded for the first time from this area. The colour variations and seasonal changes in the various species have been described, and a number of new distinctive features discovered.

77. On a method of trapping fish from floodwater in the rice fields of Assam.

N. N. Majumdar, Delhi.

In this paper an ingenious method of trapping fish from flood water is described. Before the flood comes the inhabitants make a trap by digging pits alongside the rice fields and after the flood subsides the pits which get filled up with water are searched for fishes. This method is found in practice in Assam.

The paper is illustrated with lantern slides showing details of the type of pits that are made for the purpose.

78. A review of Present-Day Fishery Research in U.S.A.

Brahma S. Kaushiva, Lucknow.

79 Effect of different Combination and Concentration of Oxygen and Carbondioxide on Larva, fry a fingerlings of Indian Food Fishes Catla catla (Ham) Labeo rohita (Ham), Labeo bata (Ham) and Cirrhina mrigala (Ham)

S. P. Basu, Calcutta.

In the small universe as is obtained in the usual laboratory set ups i.e. closed system used by earlier investigators, the products of matabolism tend to accumulate and this may not be comparable to field conditions.

Various methods such as de-aeration, sealing the water surface with a layer of oil after boiling and continued boiling were tried to get a continious flow of water. Finally a simple apparatus has been standardised by the author which deliver 1200-1500 c.c. of deoxygenated water with 0 05 p.p.m. or less per minute. A new technique based with varying proportion of O_2 and CO_2. A long tube with inlet and outlet has been taken which has a constant supply of tap water and O_2 and CO_2 is bubbled from cylinder through a bent tube in it at definite pressure. The advantage of passing the gas through a bent tube is that the size of the bubbles, time of exposure of each bubble and number of bubbles are controlled. The water charged with gases is drawn to the aspirator bottle from the middle of this straight tube so that remaining half of the water column above the inlet tube serves as a balancing column. This procedure provides an uniform concentration of the gases in the water supplied to the aspirator bottle in which deoxygenated water is also delivered at the bottom. The apparatus has a constant supply of cold water from tap at the same rate as the outflowing water through experimental flasks. Rate of flow and temperature can be controlled in the apparatus.

Larvae, fry and fingerlings of Indian carps *Catla catla*, *Labeo rohita*, *Labeo bata* and *Cirrhina mrigala* measuring 4-5 mm. 1-2 cm. 4-8 cm. and 10-16 cm. in length and on an average weight varying from 1.1-1.2 mg. .08-0.1 gms. 0.25 to 0.4 and 8-16 mgs. were exposed in a continuous flow system carrying oxygen concentration of the order of 0.1, 0.5, 1, 2, 3 and 4 p.p.m. of O_2.

The results indicate that larvae and fry upto 8 cm. can live in water containing 0.5 p.p.m. for 24 hours or more provided other conditions remain optimum. They die within a short time below 0.5 p.p.m. of O_2.

The fingerlings (10-15) cm. cannot stand O_2 below 1 p.p.m. and die within short time, whereas they can continue for 24 hours or more in 1 p.p.m. of O_2 other conditions remaining optimum. Gold fish was used as a test animal and the result shows that it can live in 0.5 p.p.m. of O_2.

The larvae and fry (4-5 mm. and 4-8 cm.) were also subjected to a combination of 0.5, 1, 2 and 3 p.p.m. of O_2 with 2.5, 5, 7.5, 10, 12.5, 17.5, 30, 60, 100, 125, 150, 175, 200, 250 p.p.m. of CO_2 to find out the respiratory metabolism of fishes in different levels of O_2 and CO_2 and also the minimum and maximum CO_2 optima.

The results indicate that larvae cannot stand 0.5 p.p.m. of O_2 with 2.5 p.p.m. CO_2, with 1, 2, 3 and 4 p.p.m. of O_2 it can stand upto 7.5 p.p.m. CO_2. In case of fry (1.2 and 4-8 cm.) it can stand 0.5 p.p.m. O_2 with 15 p.p.m. CO_2 but die in 0.5 p.p.m. O_2 with 17.5 p.p.m. CO_2, when O_2 is increased to 1, 2, 3 and 4 p.p.m. the fry can stand 125 p.p.m. CO_2, half of it dies in 150-175 p.p.m. CO_2 and all die between 175-250 p.p.m. CO_2. The fingerling (10-15 cm.) can stand 2.5 and 5 p.p.m. of CO_2 with 1 p.p.m. O_2 and with 7.5 p.p.m. CO_2 *Catla catla* and *Labeo bata* die. *Cirrhina mrigala* and *Labeo rohita* can stand 1 p.p.m. O_2 with 10 p.p.m. CO_2. All the fish die at 1 p.p.m. O_2 and 12.5 p.p.m. CO_2 except gold fish which can tolerate 100 p.p.m. CO_2 with 1 p.p.m, O_2 but feels uncomfortable at 150 p.p.m. CO_2 and dies in 200 p.p.m. When O_2 is increased to 2 to 4 it can stand 200-250 p.p.m. CO_2. The results further indicate that in the case of fingerlings there is a minimum and maximum CO_2 optima, which is absent in the case of larvae and fry upto 8 cm. Temperature and activity of fishes has a distinct effect on O_2 requirements. Further detailed work on the fore going aspect with hypertension of O_2 and CO_2 is in progress. Miligram of O_2 used per gram body weight per hour, pH, alkalinity, temperature, electrical conductivity, rate of flow of water in c.c. per minute and the behaviour of fishes at different oxygen and CO_2 levels have been recorded.

80. The Role of Banana Steam and its Juice in Controlling Hydrogen ion Concentration of Fish Ponds.

S. P. Basu, Calcutta.

Indigenous practice of using banana stem and juice by the fish farmers of Bengal, during mortality of fishes in ponds has been described. Field observations in some ponds in Singur, Bengal, treated with banana stem during mortality of fishes have given satisactory results.

With a view to understand the basic scientific principles involved and to standardise this practice on a commercial basis, experiments on the effect of addition of banana stem and its juice to varying concentrations of CO_2 have been carried out.

The results indicate that banana stem juice has an acid pH (5.2-5.7) and contains considerable amount of methyl orange alkalinity. When pond water is treated with banana stem or its juice, the pH of the pond water is reduced slightly but its buffering capacity increases considerably due to added methyl orange alkalinity.

32·5 p·p m· of CO_2 changes pH of pond water by 0·7 units whereas the same water treated with banana stem or its juice requires CO_2 of the order of 150 p.p.m. to lower the pH to that extent.

Various types of pond water treated with different varieties of banana stem or juice gave almost the same result.

81. Experiments on the Transport of Larvae of Indian Craps with oxygen in a closed System.

S. P. Basu, Calcutta.

Experiments on the transport of larvae of Indian Carps *Catla catla* (Ham), *Labeo rohita* (Ham), *Cirrhina mrigala* (Ham), *Labeo bata* (Ham) etc. were carried out in a series of experimental flasks of 3500 c.c. capacity with different concentrations of larvae and displacing half of the water of the experimental flasks with oxygen. D.O., CO_2, alkalinity, temperature, turbidity, residual chlorine and electrical conductivity determined before and after experiment.

The results indicate that in spite of the presence of oxygen, the larvae died due to high CO_2, the bacterial population and decomposition of dead larvae inside the flasks.

The amount of O_2 required by larvae and the production of CO_2 is negligible. Secondary growth of other organisms in the medium demand more O_2 and produce CO_2 as a result of putrefaction of dead larvae, Disinfectants like $KMnO_4$ in concentrations of 1 in 100,000, 200,000 and 500,000 and chlorine in concentration of 0.5 and 1 p.p.m. was tried to supress the bacterial population. Continuous disinfection with silver electrode was also used to control bacterial activity. In addition marble chips were used to control pH in the medium. Chlorine and silver electrode with merble chips gave good results. $KMnO_4$ was not suitable for the purpose.

An attempt is being made to evolve a standard transport can making use of the above findings and observations.

AMPHIBIA

82. The Heart of Rana tigrina Daud.

B. C. Mahendra *and* Hira Lal Sharma, Agra.

The authors have studied the minute anatomy of the heart of *Rana tigrina* Daud, in several series of transverse, frontal and sagittal sections and have discovered a number of features, not hitherto described. Each vena cava anterior, before opening into the sinus venosus, forms a dilatation, separated from the sinus by a neck-shaped constriction bearing a pair of valves. The sinuauricular aperture is not "transverse oval" as previously described, but transversely directed, sub-triangular in appearance. The walls of the pulmonary veins are arterial in structure and open into a recessus pulmonalis. The coronary sulcus is not transverse, but oblique. The septum atriorum extends beyond the atrio-ventricular aperature into the lumen of the ventricle and is united to both the dorsal and the ventral valve. The bases of these valves are supported by nodules of elastic fibres. The auricles open into the ventricle by a short cavity, bearing four valves. The ventricular space is neither single nor central, as usually believed, but can be divided into five cavities (the atrio-ventricular, central, right and left antero-lateral, and apical), which have been studied in detail. The internal structure of the truncus arteriosus and the exact disposition and origin of the arches also show important details differing from previous description.

83. Abnormality in Arterial System with Changes in Urogenital Organs of a common Indian toad, Bufo melanostictus Schneid.

Birendrakumar Mitra, Calcutta.

An unusual case of abnormality in arterial system with changes in urogenital organs of a common Indian toad, *Bufo melanostictus* Schneid, has been studied. Brief reference to the courses of arterial arches and their main branches, is given. Changes in urogenital organs are also described here. Origin of Coeliaco-mesenteric artery from the only systemic arch of the right side, has been redefined. Pigmentation of the sub-gular and abdominal skin, presence of vocal sac, stout and swollen fore-arms with nuptial pads or excresences as found by Liu. (1935, 1936) are tenable here. A few prominent skeletal muscles, linea alba and linea masculina which are so characteristic of a normal male toad of Indian type, are present in this specimen which otherwise appeared to be a healthy full grown male toad.

Hypertrophic carotid labyrinth or the so called carotid gland of the left internal carotid artery has been described as an organ responsible for raising the blood pressure of the defective circulation through the heart which has hypertrophic ventricle and bulbus cordis.

Attention has been drawn to the histology of certain endrocrine and urogenital organs. So far as the present author is aware, some of the anatomical peculiarities noted above are remarkable and have not been recorded in the Anura. The problem of tracing them to the structural peculiarities is now engaging his attention.

84. On the Food of the Common Pond Frog, Rana hexadactyla Less, with special referenee to pisciculture.

P. I. Cnacko *and* B. Krisnnamurthi, Madras.

A qualitative and quantitative analysis of the gut of 250 specimens of *Rana hexardabtyla* indicates that the food of this amphibian consists mainly of water insects, wate plants and leazes and flowers of shore trees. Fisheso of small size and yf uneconomical importance were found in five stomaches nnly. The improbability of the frog adverselA affecting ysy production is discussed.

85. The Closure of the Nares in Rana tigrina Daud.

Chandra Pal Singh *and* B. K. Randhar, Agra.

The authors have performed a series of careful experiments on the closure of the narial apertures in *Rana tigrina* Daud. The hitherto accepted view that the closure is effected by the elevation of the tip of the lower jaw playing against the premaxillaries and forcing them upwards to close the nostrils, seems to be untenable.

REPTILIA

86. The Venous System of Varanus monitor (Linne).

Surendra Sharma, Agra.

The venous system of *Varanus monitor* (Linne) was studied in details. The more important features discovered by the author are as follows :—

1. The Precaval vein is the backward extension of the internal jugular.
2. The Vena azygos arises from the precaval on the right side, is connected with the supra-renal portal system of that side by the dorsal parieto-hepatic vein, and breaks up into a number of vertebral veins on the left side.
3. The vena prebrachialis ends on the dorsal side of the shoulder, and the vena axillaris extends on the preaxial border of the upper arm.
4. The external jugular vein is variable in its disposition and in the number of its plexuses.
5. The renal veins arise intra-renally.
6. On the left side a vein from the vertebral column forms part of the supra-renal portal system.
7. The venae pelvicae are continuations of the femoral.
8. A vena epigastrica media is present.
9. The femoral vein is connected with the renal portal.
10. The united ischiomesenterics continue as a component of the hepatic portal system.
11. A pair of venae inguinalis is present.
12. The vena gastrica anterior is a vein separate from the anterior abdominal, and the vena gasterolinealis and the vena intestinalis posterior unite to form a vena intestino-gastero-linealis which forms part of the hepatic portal system.

AVES

87. Some observations on the shank colour of Indian fowls.

B. R. Sen Gupta, H. P. Tandon *and* S. G. Iyer, Izatnagar.

The behaviour of dark and yellow shank colourations in an improved strain of Indian fowl has been studied by breeding experiments. In certain matings, among the first generation progeny, the dark colour predominated over the yellow. The results also revealed no association of dark or yellow shank with sex. Out of the four matings made, in one mating, however, there was a suggestion that the parental stocks would breed true to the character, in this case dark shank colour. In the case of two reciprocal matings 50% of the progeny were dark and 50% yellow.